Heating Piping & Air Conditioning

FEBRUARY 1958

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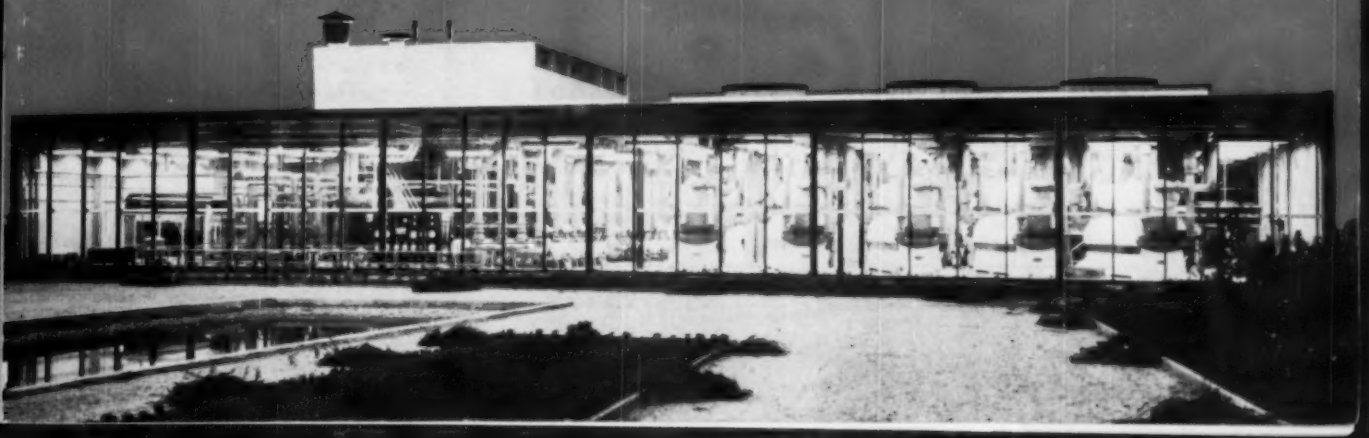
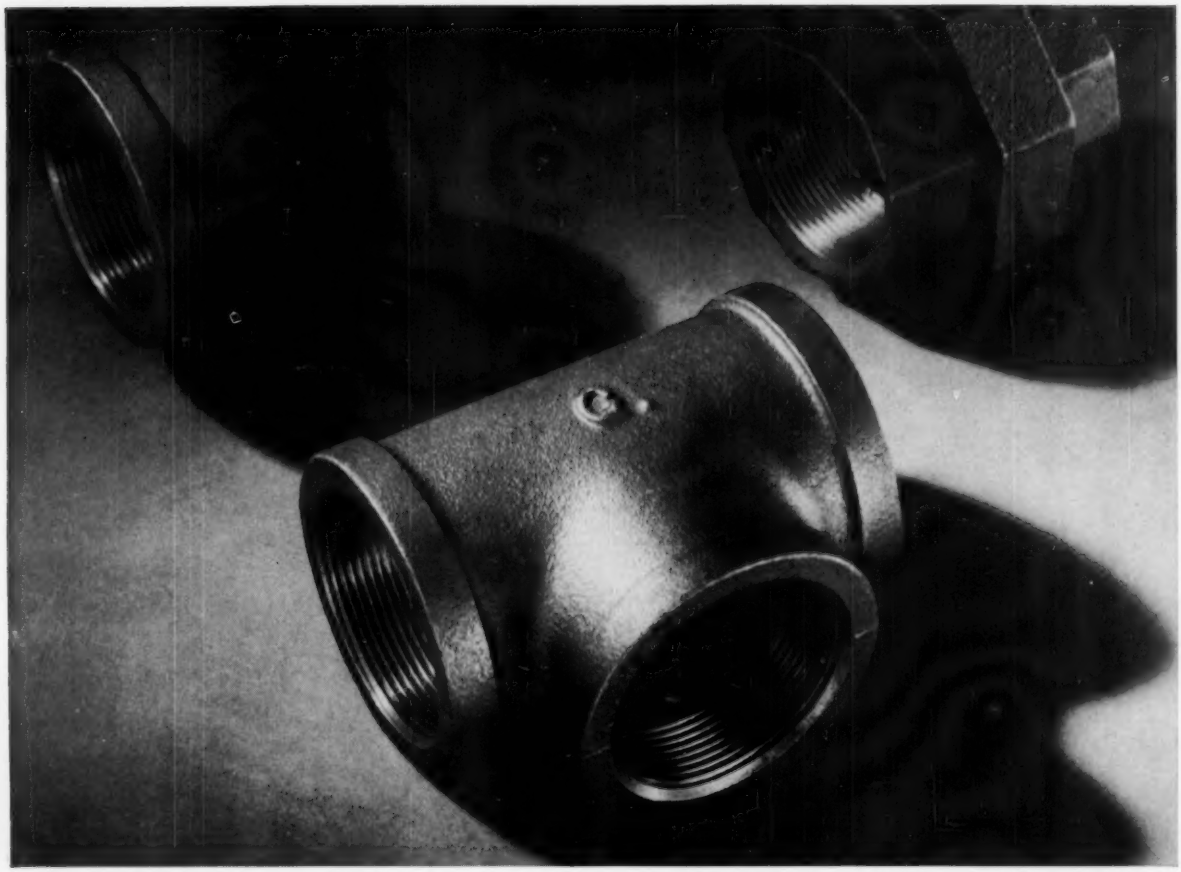
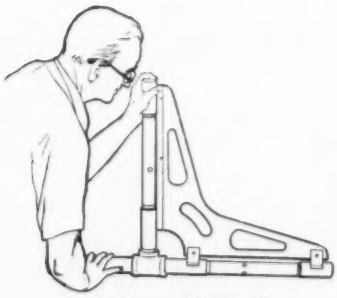




PRECISION QUALITY

from foundry to finished fitting – modern inspection methods insure the quality of

GRINNELL PIPE FITTINGS



Alignment Gauging for Dimensional Accuracy

For instance, for malleable fittings, laboratory technicians make an hourly chemical analysis of foundry metal to insure uniform, high quality. Daily tests by photo-micrograph reveal metal structures. Sample bars from each melt are subjected to tensile strength tests. Grinnell quality control also includes alignment tests, pressure tests, thread gauging and comparator checks on the accuracy of threads and chamfer, in addition to visual inspection.

To make fittings the safest, strongest link in your piping system . . . choose from the wide Grinnell line of cast iron and malleable iron fittings; also bronze-to-iron unions. Look for the raised "G" when you buy.

When you specify Grinnell Pipe Fittings, you are sure of . . .

- High quality metal, free from sand holes and wall leaks
- Uniform wall thickness—no weak spots
- Clean inside surface for smooth flow
- Substantial flat band for sure pipe wrench grip
- Dimensional accuracy
- Precision threads for easy running-up and tight joints
- Proper chamfer for easy starting and protection of first thread

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

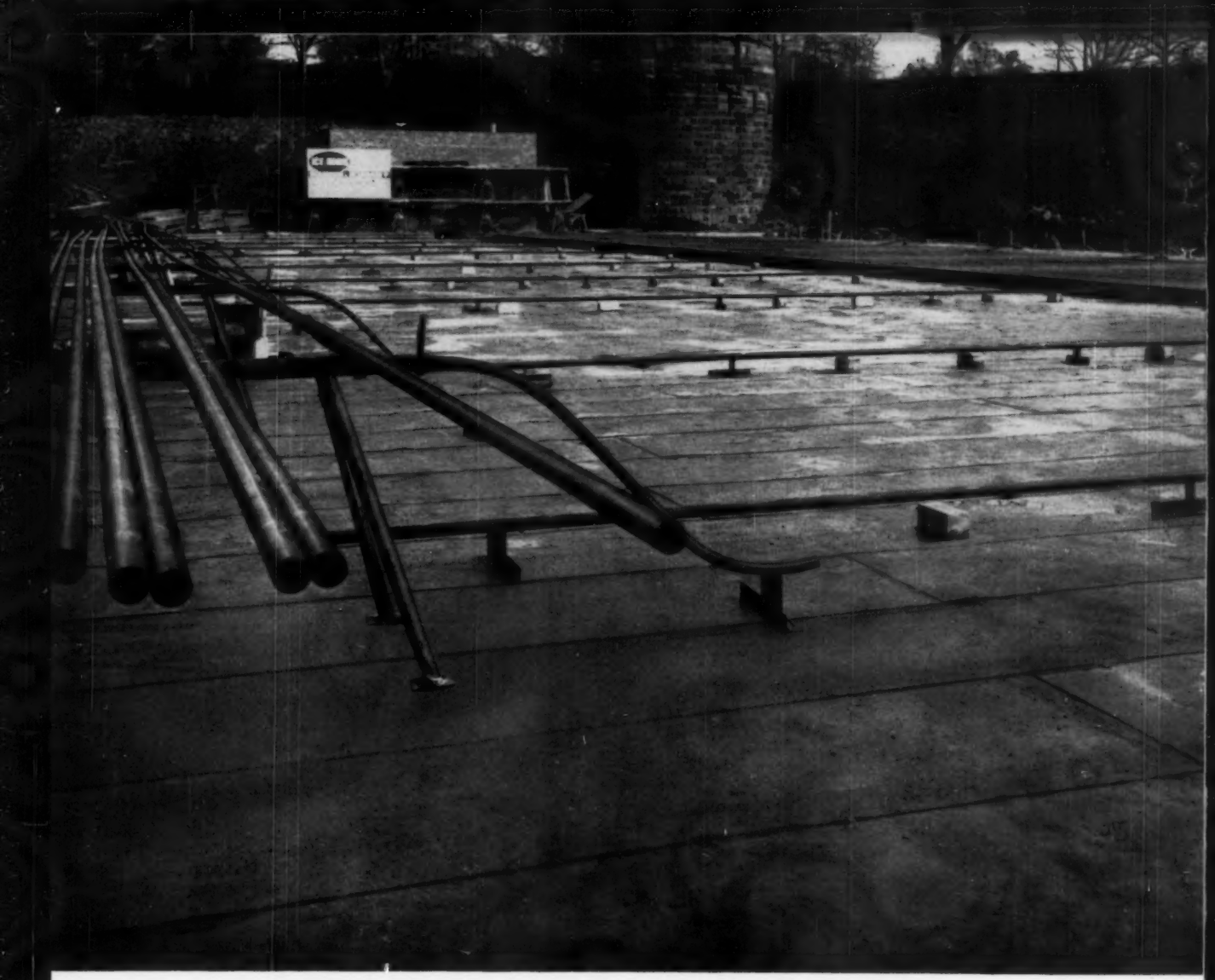
AS SIMPLE AND SURE AS BUYING AIR THIS WAY . . .

A $250,000 Performance Bond backs every published rating of DeBothezat Fans so you can be certain of their actual on-the-job performance. Ratings are obtained from tests on *completely assembled* fan units in DeBothezat's own advanced laboratories. Accurate wind tunnel tests are made in accordance with the appropriate NAFM plate . . . conform to U. S. Dept. of Commerce Standard 178-51. Specify DeBothezat and you never have to make allowances "to be on the safe side."

De Bothezat FANS
A DIVISION OF
American Machine and Metals, Inc.
DEPT. HP-258 EAST MOLINE, ILLINOIS

FOR FURTHER INFORMATION
SEE OUR CATALOG IN SWEET'S
OR WRITE FOR COPY

For further information, see our section in Sweet's Plant Engineering or Industrial Construction Catalog, or write for copy.



Peter Carver Associates, New York City mechanical engineering firm, designed this device for rolling welded pipe lengths from welding platform into position on the rink floor.

Unique cradle launches 200′ Wrought Iron Pipe sections . . . speeds installation, eases fabrication

Any time we hear of unusual piping practice in the field which will ease fabrication and handling, and speed installation, you can bet we'll pass it on to you.

The installation is an outdoor skating rink at Branch Park, Newark, New Jersey, for the Essex County Park Commission. The material is 1¼-inch wrought iron pipe. And the fabricators are Richardson and Richardson Company, Nutley, New Jersey.

Use of the cradle (in the photo above), permits easy, continuous welding at waist level. Pipe is welded into 200-foot lengths, then rolled from the cradle and skidded into position on the rink floor. Weld stress is thus minimized, reducing the possibility of bends in the long pipe sections.

Wrought iron's self-fluxing nature enabled welders to easily produce sound, durable welds. And the outstanding corrosion resistance of this material assures owners low cost per year of service.

If you'd like answers to any of your installation questions concerning wrought iron pipe, drop a line to our Engineering Service Department. Or write for our *Special Report, Ice Skating Rinks—Their Construction and Maintenance.* A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

Corrosion costs you more than Wrought Iron

Heating Piping & Air Conditioning

Vol. 30, No. 2

[With which is merged the Aerologist]

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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One in a series.

How to Select a Steam Trap Big Enough for the Job

Adequate capacity safety factors are essential to operating efficiency

As promised to you in a previous Armstrong trap advertisement in this publication, here is some helpful information on steam trap safety factors.

First, the definition. A trap safety factor is simply the ratio between actual continuous discharge capacity of the trap and normal condensate load. If the load is 500 lb/hr and the trap actually will discharge at the rate of 1000 lb/hr, the safety factor is said to be 2 to 1, and so on.

Why a Safety Factor?

You are not going to get maximum heat transfer efficiency from any steam heated unit unless your traps are sized with a generous excess of capacity over the normal condensate load.

Remember that trap capacity is given in terms of *continuous* discharge of condensate at a given pressure differential. If you don't employ an adequate safety factor, you make no provision for these requirements or conditions:

1. ***Venting of gas,*** O_2 and CO_2, would be impossible if a trap should discharge a full stream of water continuously.

2. ***Peak loads*** would back up condensate in the line or unit if the trap were sized for average load.

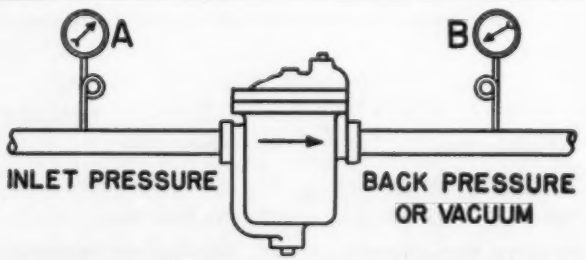
3. ***Reduction in pressure differential*** across the trap orifice would reduce capacity below requirements. If steam pressure drops below normal, trap capacity is lowered more than condensing rate. An increase in back pressure for any reason cuts trap capacity. And, pressure differentials often drop substantially during warming-up periods.

4. ***"Group" trapping.*** Very occasionally it is impractical to use an individual trap on each coil or condensing unit. Here, a generously oversized trap helps prevent backup of condensate or air from one unit to another. The frequent opening of a big trap valve "pumps" non-condensibles and condensate to the drain header.

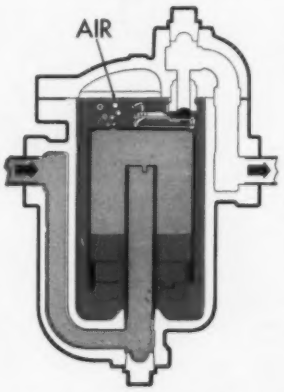
What Safety Factor?

Fortunately, it isn't necessary to calculate safety factors. Experience is the best guide and the benefit of experience with tens of thousands of successful installations is available to you. The following table is taken from the Armstrong Steam Trap Book.

Page	Equipment Drained	Safety Factors
24	Purifiers and Separators	2 or 3 to 1
25	Steam Mains or Headers	2 or 3 to 1
26	Steam Heating Pipes...	2 to 1 up to 6 to 1
29	Unit Heaters	3 to 1
30	Submerged Coils	2, 3 or 4 to 1
32	Cylinder Dryers	4 to 1 up to 10 to 1



Pressure differential affects trap capacity. If "B" is back pressure, subtract from "A"; if "B" is vacuum, add to "A". Safety factors compensate for drops in pressure differential.



Traps vent air. This requires a trap capacity safety factor.

The page numbers listed contain completely reliable data for any trapping job.

CAUTION. The safety factors recommended in The Armstrong Steam Trap Book will have to be increased by an unknown factor for trap capacity ratings based on cold water tests, orifice tests or slide rule calculations. Armstrong trap steam temperature condensate capacity ratings are based on actual operating conditions which take into account such capacity-reducing factors as pipe friction and the choking effect of flash steam.

If you'd like to have a copy of the 44-page Steam Trap Book, just call your local Armstrong Representative, or write the factory. There is no obligation.

Armstrong Machine Works
8742 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

WE'RE Mighty Proud OF YOUNGSTOWN'S DISTRIBUTORS

Youngstown Distributors are in business for only one reason—to quickly supply what you want, when you want it, and in the quantity you require. They provide you the highest quality Youngstown Pipe at the right price—by coordinating their distribution with our mill production. Yes, our hat's really off to these valuable around-the-clock suppliers for the important function they daily perform to industry.

It will pay you to know and use your Youngstown Distributor because his:

- Large stocks are immediately available which allows a reduction in your inventory.
- Single source of supply will simplify and speed up your purchasing, receiving and bookkeeping.
- Service is available around-the-clock, 365 days a year.
- Salesmen can offer valuable information on products and processes because they are constantly in touch with leading industrial plants.

Your Youngstown Distributor is as near as your telephone—why not call him today?

Specify Youngstown and secure these 7 Points of uniform goodness

uniform ductility
uniform lengths
uniform threading
uniform weldability
uniform wall thickness and size
uniform strength and toughness
uniform roundness and straightness

THE Youngstown SHEET AND TUBE COMPANY

General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN PIPE

PRODUCERS OF QUALITY CARBON AND ALLOY STEELS FOR OVER HALF-A-CENTURY

Here is the complete packaged cooling tower story . . . and the twentieth edition is just like the first—ALL MARLEY. Every year Marley know-how and Marley production ability write new, important chapters; they are so comprehensive that they cover the field from A to Z. That's why they are the industry's

BEST SELLERS OF '58

11 Models with Nominal Capacities from 3 to 60 Tons

Hot Dip Galvanized After Fabrication—Prevents corrosion, assures longest service life

Diffusion Decks—Exclusive feature; essential to efficient initial water break-up

Close-Packed Filling Cube—More wetted surface, more performance per cubic foot

Drift Eliminators—Prolong service life of mechanical equipment; keep tower site dry

Air Inlet Louvers—Balance air flow, prevent splash-out

Marley Type L Fan—Most rugged fan used on towers of this type; non-overloading, prevents over-heating motor

Fan Venturi—Greatly reduces fan noise and entrance loss

Stainless Steel Fan Shaft—Mounted in Bronze Sleeve Bearings

Clamp-Down Design—Permits quick disassembly and reassembly of all models when necessary

MARLEY MARLEY MARLEY

Every job deserves Marley quality and every job can have it. Whatever the requirement — induced draft, forced draft, natural draft—the tower pin-pointed for the application is in the complete Marley line. Never a need to compromise on size, style or structural material — Marley makes them all available.

And of equal importance, when you select Marley you gain two partners earnestly interested in the success of every job: your Marley distributor and Marley. The distributor who sells Marley towers has been carefully selected for his willingness and ability to serve you both before and after your purchase. He, in turn, is backed by The Marley Company's assurance that every product will be satisfactory to every purchaser — a guarantee fulfilled for 35 years.

Today's market makes this teamwork important on every job and Marley makes it available to you with every tower you install.

The Marley Company

222 W. Gregory Blvd., Kansas City, Mo.

Aquacoolers®

Nine models with capacities nominally rated from 5 to 50 tons

For installation indoors or out

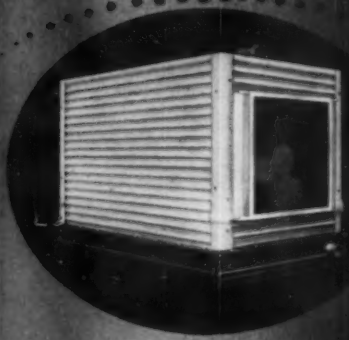
Consistent, full capacity performance

Whisper-quiet operation

Requires minimum plan area

Adjustable air delivery

MARLEY



WOOD AQUATOWERS

Five models with capacities nominally rated from 5 to 50 tons

Designed for maximum resistance to corrosion

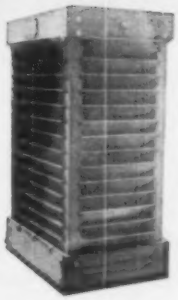
Forced draft design

Can be installed in confined areas

Blends harmoniously with any surroundings

Shipped unassembled for easiest handling at job site

SPRATOWERS®



A complete range of capacities

Provides maximum water cooling economy

Non-clog bronze spray nozzles

Balanced spray system

Long-life redwood construction

Prefabricated for quick installation

MARLEY

Know-how makes the

IN HEATER APPLICATION

The new Dravo *Counterflo* has performance built in . . . the kind of performance possible only in a heater in which every part has been designed and built to function as an integrated unit. But it is the skill with which this performance is applied to the solution of a specific heating problem that makes it completely effective.

This is the important "extra" that every Dravo Heater customer gets. *Every* Dravo technical representative *is a qualified heating engineer* skilled at solving all kinds of heating problems in all types of industrial and commercial buildings.

Every man is competent to make a complete heating survey of your installation, working in cooperation with your engineering departments or consultant.

Every man is backed by the home office staff, who can bring both laboratory facilities and the total experience of over 10,000 installations to bear on unusual problems.

Get the benefit of this Dravo "extra" when *you* have a heating problem.

difference

IN HEATER DESIGN

The new Dravo *Counterflo* heater, developed by an exhaustive research program, represents an important advance in warm air space heating. Its "unitized" design, making each part integrate smoothly with the functioning of the rest, and the fact that each part was designed specifically for its function, makes the new *Counterflo* unique.

DRAVO
CORPORATION

Here are some of the features which make the new *Counterflo* heater your best heating buy:

NEW PYROJET BURNER—exclusively Dravo—first burner developed specifically for direct-fired space heaters. Burns low cost oils efficiently. Switches from gas to light oil automatically.

NEW INDUCED DRAFT FIRING—automatically controls fuel/combustion air ratio, high negative pressure in combustion chamber adds extra safety; extra efficiency because of complete control of combustion air.

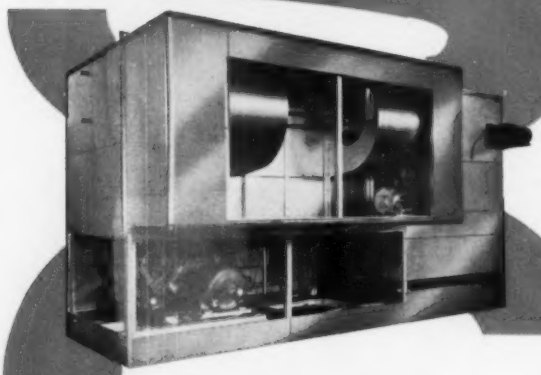
NEW AIRFOIL COMBUSTION CHAMBER—stainless steel, ribbed for extra strength and channeling of airflow—guaranteed for 10 years. Longest possible flame travel for complete combustion within primary heat transfer area.

NEW LOW-SPEED FANS—forwardly curved, low-speed, double inlet fans with high efficiency reduce horsepower requirements in the new Counterflo drastically, operating costs are lower.

NEW DISCHARGE PLENUM—distributes heated air at high velocity without annoying drafts. Adds new flexibility to warm air distribution patterns.

Bulletin 564 describes the many new features of the new Dravo Counterflo heater. Write or phone for your copy today. Address Dravo Corporation, Dravo Building, Pittsburgh 22, Pennsylvania.

"SATISFABRICATED"® For Your Requirements . . .



GOVERNAIR'S NEW

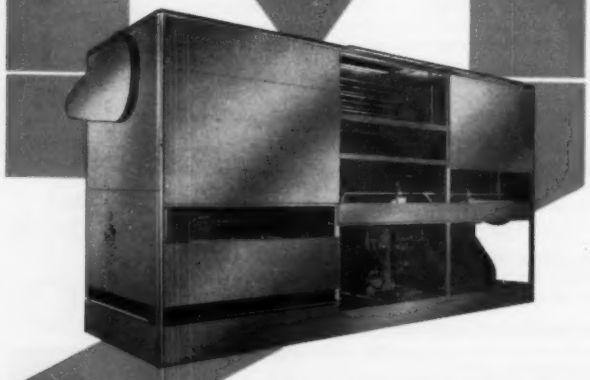
Self Contained Multi-Zone Conditioners . . . Type SCMZ

IMPORTANT FEATURES:

- FROM 7½ to 60 TONS COMPLETELY PACKAGED
- EITHER 4 ROW, 5 ROW OR 6 ROW COILS
- TWO INDEPENDENT REFRIGERANT CYCLES, IF REQUIRED
- DESIGNED WITH F-22 COMPRESSORS
- LESS INSTALLATION TIME AND TROUBLE
- ONE UNIT SATISFIES YOUR AIR CONDITIONING REQUIREMENTS

The new SCMZ is designed for complete flexibility . . . provides the desired latitude necessary to meet the exacting requirements and unusual space limitations not available in the majority of today's mass produced, unalterable packaged conditioners.

Governair's "Satisfabricated" Self Contained Units have all the basic components of a complete air conditioning system, conditioner section, compressor section, and evaporative condenser section. In these units all refrigerant piping and electrical connections are completed internally by factory-trained craftsman, and carefully supervised to assure proper operation on the job. Simple connection of duct work, electrical, make-up water and drain provide fast and economical installation.



Get Full Details Now

GOVERNAIR

GOVERNAIR CORPORATION
4840 North Sewell
Oklahoma City, Oklahoma

"ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS"

Why modern hospitals are being equipped with Sarcotherm heating control systems

Why hospitals find Sarcotherm Systems ideal.

1. *Flexibility* — these systems, because of their great adaptability, can be applied to satisfy the varying heating control requirements of a specific hospital.

2. *Dependability* — because of simplicity, no complicated mechanisms. Only a few simple, rugged instruments. Minimum of wiring and piping. Self-powered mixing valves require no electricity or compressed air. Result: uninterrupted heating comfort, long service life.

3. *Ease of temperature setting* — regular hospital maintenance men quickly, easily make adjustments.

4. *Practically no maintenance* — rugged construction and few parts insure long trouble-free operation. Self-powered thermostatic system embodies performance stability developed through half a century of Sarco experience.

SOME TYPICAL HOSPITALS EQUIPPED WITH SARCOTHERM SYSTEMS

		Number of Zones
Chatooga Hospital	Summerville, Ga.	4
Children's Hospital	Washington, D. C.	5
Community Hospital	Cumberland, Wisc.	4
Copiah County Hospital	Hazelhurst, Miss.	3
Delaware State Hospital	Farnhurst, Del.	11
Embreeville State Hospital	Embreeville, Pa.	53
Freeport Hospital	Freeport, L. I.	4
New Leake County Hospital	Carthage, Miss.	5
North Carolina State Hospital	Goldsboro, N. C.	4
Milledgeville State Hospital	Milledgeville, Ga.	13
Rabun County Hospital & Health Center	Clayton, Ga.	5
Rowan County Medical Center	Salisbury, N. C.	5
Springfield State Hospital	Syskeville, Md.	5
V. A. Hospital	Clarksburg, W. Va.	4
Woodville State Hospital	Woodville, Pa.	18
York County Home	York, Pa.	13

FOR COMPLETE CONTROL SYSTEM CATALOG, write Sarcotherm Controls, Inc., 635 Madison Ave., New York 22, N. Y.

Why architects, engineers, contractors find Sarcotherm Systems ideal for hospitals...

1. *Application engineering* — Sarcotherm engineers, backed by years of experience in hospital heating control systems, assist consulting engineers with individualized system diagrams.

2. *Easy to install* — drawings and diagrams of the complete system are furnished for each job.

3. *On-the-job assistance* — to contractors, from Sarcotherm's field engineers.

4. *Low installed cost* — because of simplicity; minimum of wiring and piping.

5. *Undivided responsibility* — complete control system plus heating specialties and accessories from one dependable source — Sarcotherm.

Hempstead General Hospital, Hempstead, L. I., N. Y.
One of the recently completed hospitals equipped with a Sarcotherm Weather-Compensated Control System for hot water heating. Installation includes 5" Sarcotherm 3-way modulating mixing valve, programmed timer, radiator valves, balancing fittings, automatic air vents and other heating specialties.

Architects — Samuel Paul and Seymour Jarmul, Jamaica, N. Y.
Heating Contractor — Seaboard Installations, Inc., New York City.

4016-B

Sarcotherm

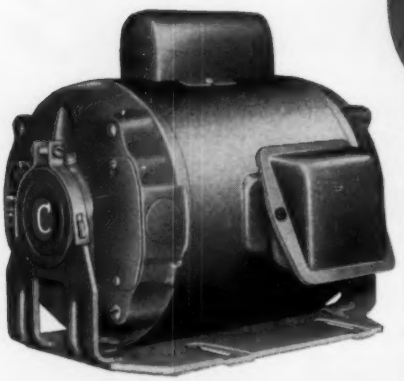
AN AFFILIATE OF SARCO CO., INC.

Weather-Compensated control systems for steam, hot water and radiant heating

Your choice of normal or low starting current... with Performance-Rated

Century

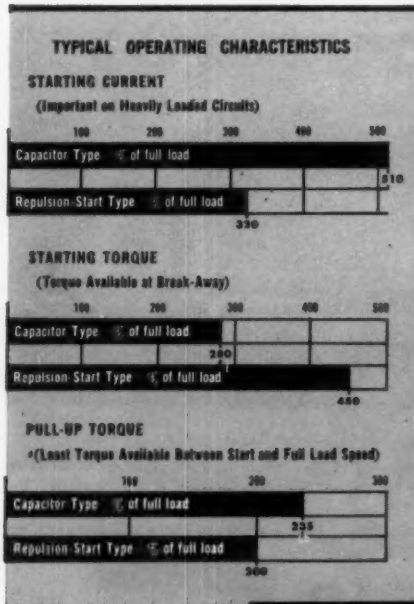
HIGH TORQUE, SINGLE-PHASE MOTORS



Capacitor Motors... ⅛ to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

Whatever Your Motor Job . . . there's a Century Motor Performance-Rated to handle it with top effectiveness. Contact your nearby Century branch office or Authorized Distributor.



Repulsion Start, Induction Motors (type RS)... ½ to 7½ H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated© Motors ⅛ to 400 H.P.

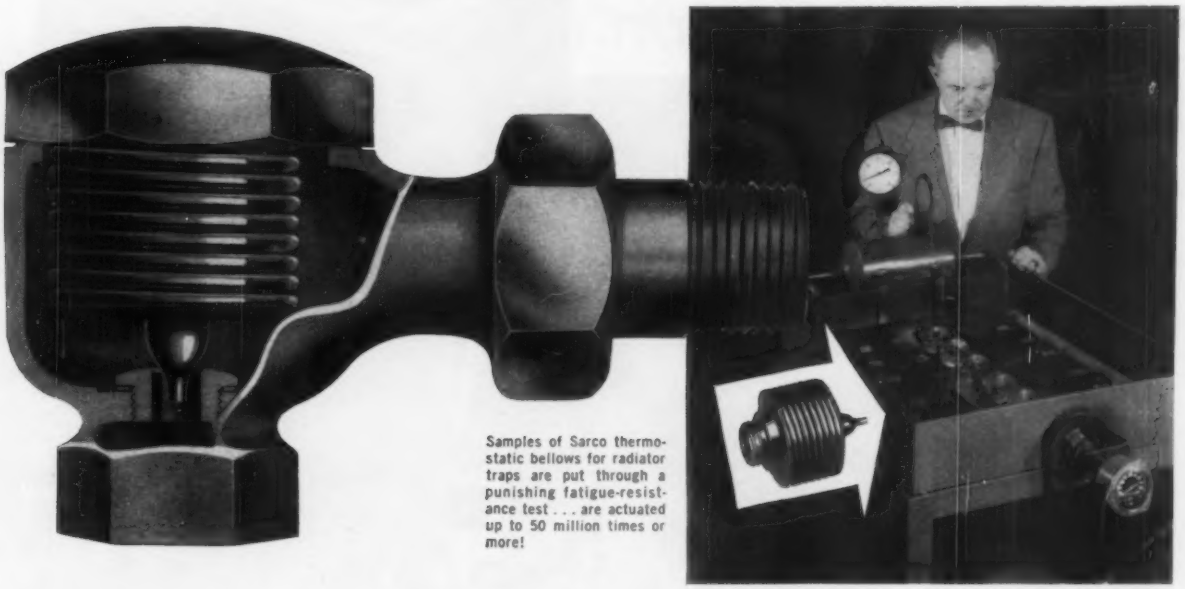
CENTURY ELECTRIC COMPANY

CE-32

1806 Pine Street, St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

50,000,000 cycles can't be wrong!

How Sarco guarantees "on-the-job" performance of Thermostatic Radiator Traps



Samples of Sarco thermostatic bellows for radiator traps are put through a punishing fatigue-resistance test . . . are actuated up to 50 million times or more!

This is the most gruelling test a thermostatic radiator trap could possibly get. It's a thermostatic bellows test that goes on endlessly . . . day after day, year after year . . . in the Sarco Research Lab.

In this Sarco research and product development work, thermostatic bellows for Sarco radiator traps are expanded and contracted 50,000,000 times or more to test and study their fatigue-resistance!

Further to assure you the utmost on-the-job dependability, production samples of Sarco thermostatic bellows are tested to *10 million cycles* and more!

OTHER IMPORTANT ADVANTAGES

Extra-strong union nut and nipple — made of bar stock, not just brass castings.

Extra-rugged body — insured by *pressure* casting. Eliminates porosity. Maximum insurance against hidden defects.

Every body pressure-tested at maximum rated steam pressure.

Removable seat — for easy replacement. Seat and self-aligning valve head made of hard bronze.

ASK FOR BULLETIN 150

FOR UNDIVIDED RESPONSIBILITY on your installations, it pays to specify and order from one "Complete Line" source . . . SARCO-SARCOTHERM. Write for catalogs — to Sarco Company, Inc., 635 Madison Ave., N.Y. 22, N.Y.

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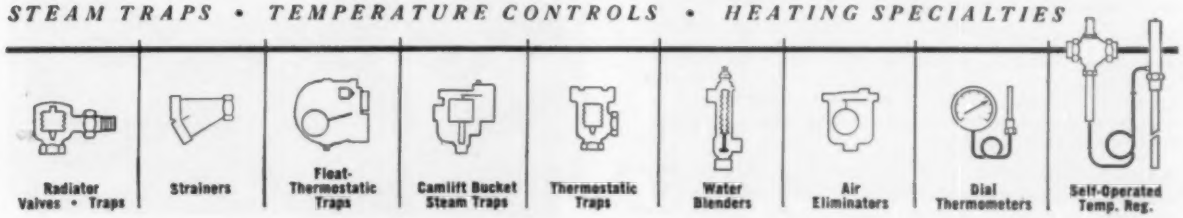
AN AFFILIATE OF SARCOTHERM CONTROLS, INC.

Products you can rest your reputation on

STEAM TRAPS • TEMPERATURE CONTROLS • HEATING SPECIALTIES



Manchester, Conn. Comprehensive Secondary School

One of New England's largest contemporary high schools accommodates over 2500 students in a building with 268,000 sq. ft. of floor space built at low construction cost of $12.88 per sq. ft.

Architects: Ebbets, Frid and Prentice, Hartford, Conn.

Mechanical Engineers: Paul D. Bemis, C. W. Freeman, Hartford, Conn.

General Contractor: M. S. Kelliher Co., Boston, Mass.

Heating and Vent. Contractor: Fredrick Raff Co., Inc., Hartford, Conn.

Science Department includes 5 general science labs, 2 chemistry labs, a physics lab, also 2 biology classrooms where students learn about the wonders of life.

The right room temperature for every school activity is provided by Powers DAY-NIGHT Thermostats.

Unoccupied rooms are held at economical lower temperatures.

The heating system is divided into 16 zones for day-night control depending on type of activity. 212 Powers thermostats control 267 convector valves, 17 large supply units, 15 unit ventilators, 8 exhaust fan systems, 23 force flow heaters and 11 unit heaters.

6-Lane Swimming Pool water temperature, radiant panel heating around the pool's edge and domestic hot water supply are all controlled by POWERS Accritem Regulators and Flowrite Valves.

Help TAXPAYERS for Your New School

Get the MONEY-SAVING BENEFITS of

POWERS Temperature Control

Good School Planning in Manchester's outstanding 91-classroom high school includes many modern features and equipment that contribute to the efficient, economical operation of its $5,000,000 investment. Accurate temperature control, for example, provides:

Thermal comfort assured by a POWERS Quality System of Temperature Control helps keep teachers happy, protects health of students, keeps them alert, aids concentration.

Lower heating costs—Powers accurate control prevents waste of fuel in overheated and unoccupied classrooms. Fuel economy alone will pay back the cost of Powers Control.

Low cost maintenance—Simplicity and year after year dependability with little attention, is one of Powers most valuable features.

15 to 30 Years of dependable control with a minimum of repairs are often reported by Powers users. Some 50 year old Powers installations are still in operation.

Prompt service by skilled Powers engineers and mechanics.

In your new school make sure taxpayers get the biggest return on their investment in accurate temperature control. Ask your architect or engineer to include a time-proven Powers Quality System of Control.

Above: one of three modern gymnasiums.

For further information contact our nearest office

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SKOKIE, ILLINOIS | *Offices in Chief Cities in U.S.A. and Canada*

65 YEARS OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL

212 Powers DAY-NIGHT Thermostats here maintain set temperature. They need no frequent checking or re-adjusting.

267 Powers PACKLESS Valves prevent water leakage, banish packing maintenance and give better control due to reduced valve stem friction.

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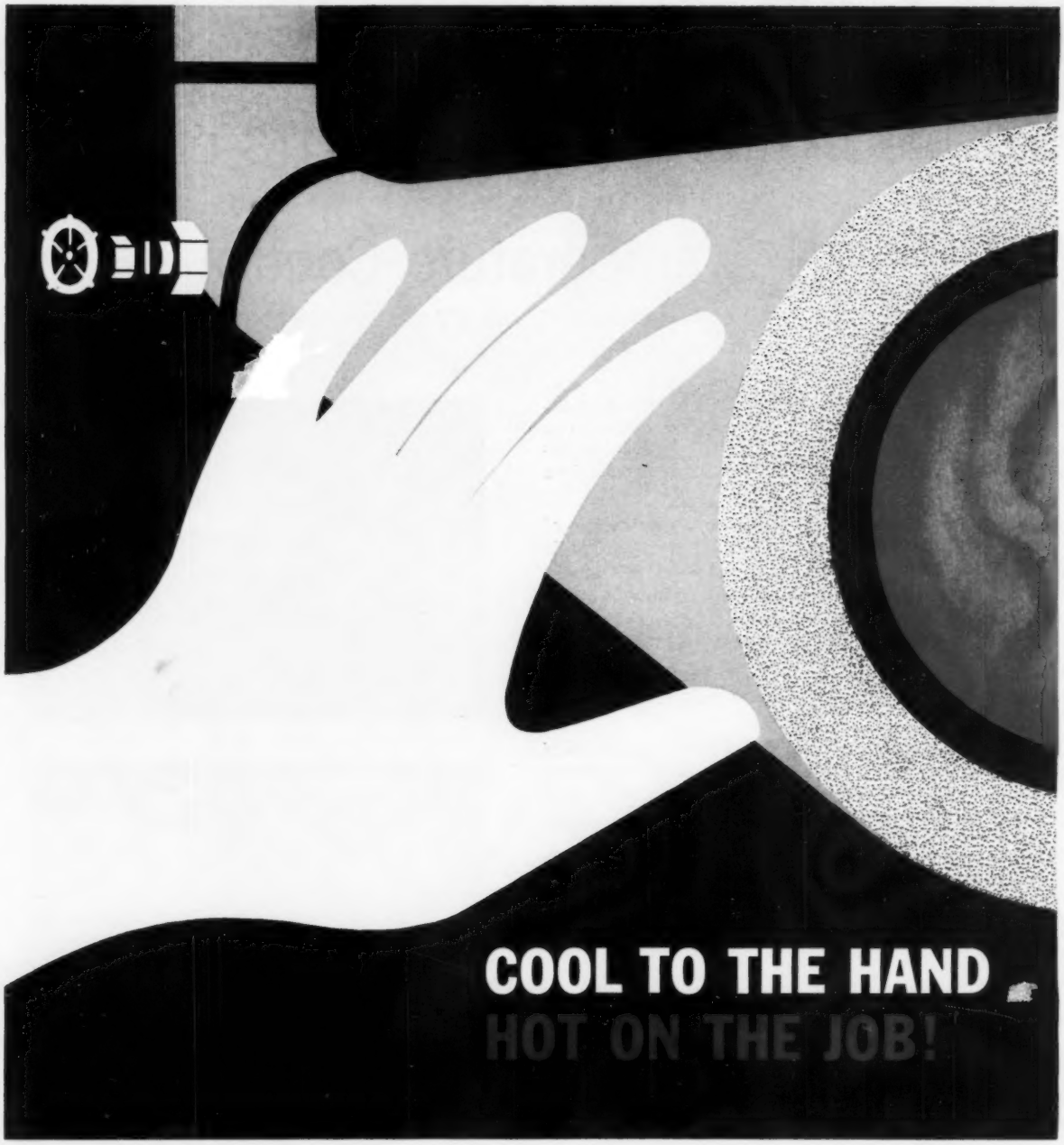

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Here's how to keep fuel costs at rockbottom . . . and make them stay there for the life of your equipment: K&M High-Pressure Insulations. Even severe operating conditions can't interfere with their insulating efficiency. They handle temperatures up to 1900°F. Come in a variety of sizes and thicknesses. In pipe or block insulation.

Write to us today for a free brochure. It shows how you can insure more precise process control . . . greater heat efficiency . . . with K&M.

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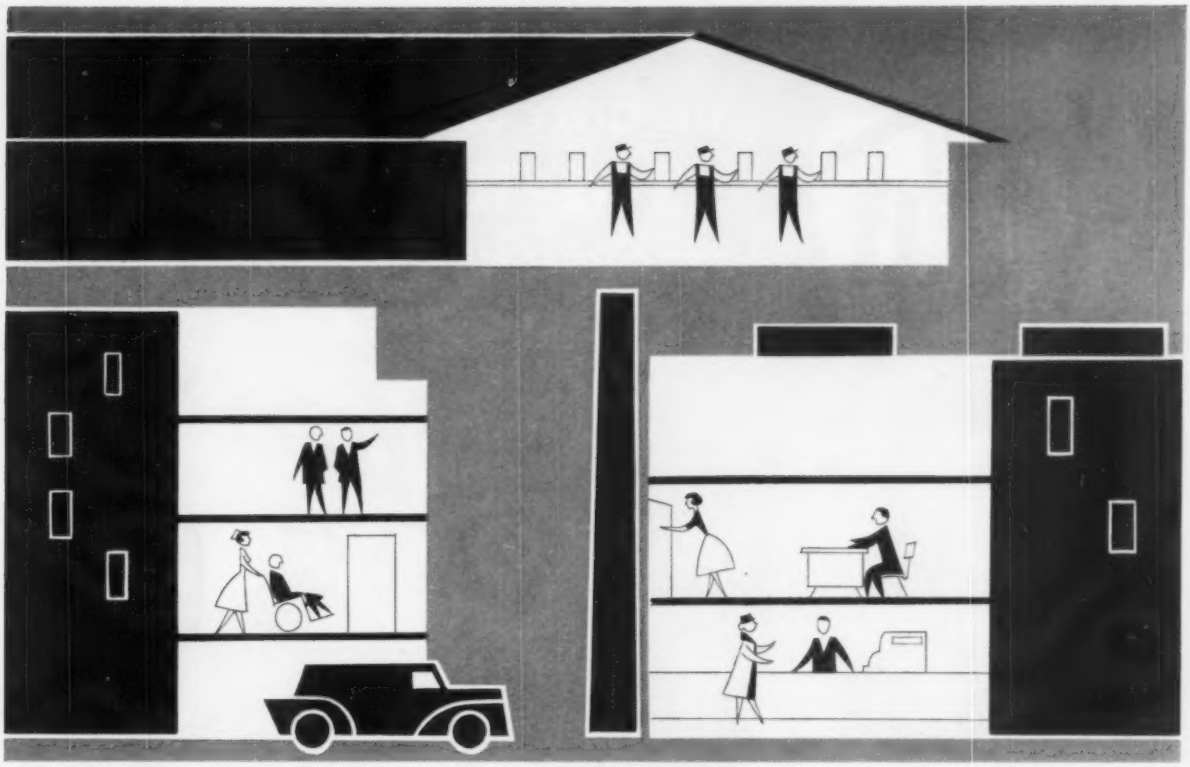


Which Crane boiler would you specify for these buildings?

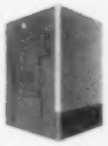
You'd have to know many vital facts about the factory, hospital, and office building above before you could specify the correct boilers.

But our point is this: whatever the specific heating requirements of a building, there's a rugged Crane Sunnyday Boiler to meet them. Hot water and steam models . . . gas, oil, and coal . . . with capacities from 280,000 to 4 million Btu/hr. gross output.

There are many sound reasons for specifying Crane Sunnyday boilers. Here are just a few: Crane offers more gas-fired boilers in commercial sizes than anyone in the industry . . . assuring a closer sizing of the boiler to load requirements. These boilers also offer universal burners that provide equal ratings on all gases.

Before you make your next bid, why not check with your Crane Branch or Crane Wholesaler on all your heating requirements.

Crane Sunnyday 30—300,000 to 1,367,000 Btu/hr.



Crane 41 Boiler—829,000 to 2,349,000 Btu/hr.

Crane Sunnyday 40—280,000 to 1,904,000 Btu/hr.

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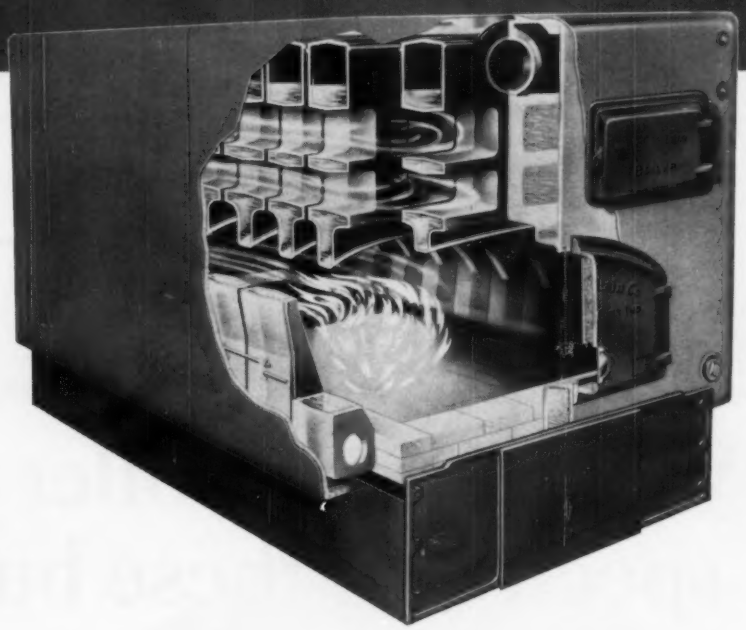

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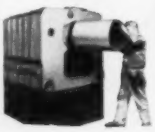

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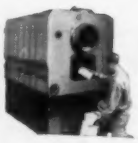

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Nos. 40 and 44

OIL and ALL-FUEL BOILERS

When you specify or install a Weil-McLain 40 or 44 Cast Iron Boiler, you can be sure that its capacity is exactly as published.

Weil-McLain ratings are established by actual output under test, based on the Institute of Boiler and Radiator Manufacturers' Testing and Rating Code for Low Pressure Cast Iron Boilers. These ratings eliminate guesswork... permit selection of correctly sized boilers.

Weil-McLain 40 and 44 Boilers are the practical selection for low pressure commercial and industrial heating systems. They can be installed in smaller boiler rooms, easily expanded in capacity and are designed to be easily maintained at top efficiency. Corrosion-resistant cast iron construction assures long, trouble-free life.

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In the spots that count... Homestead Valves are

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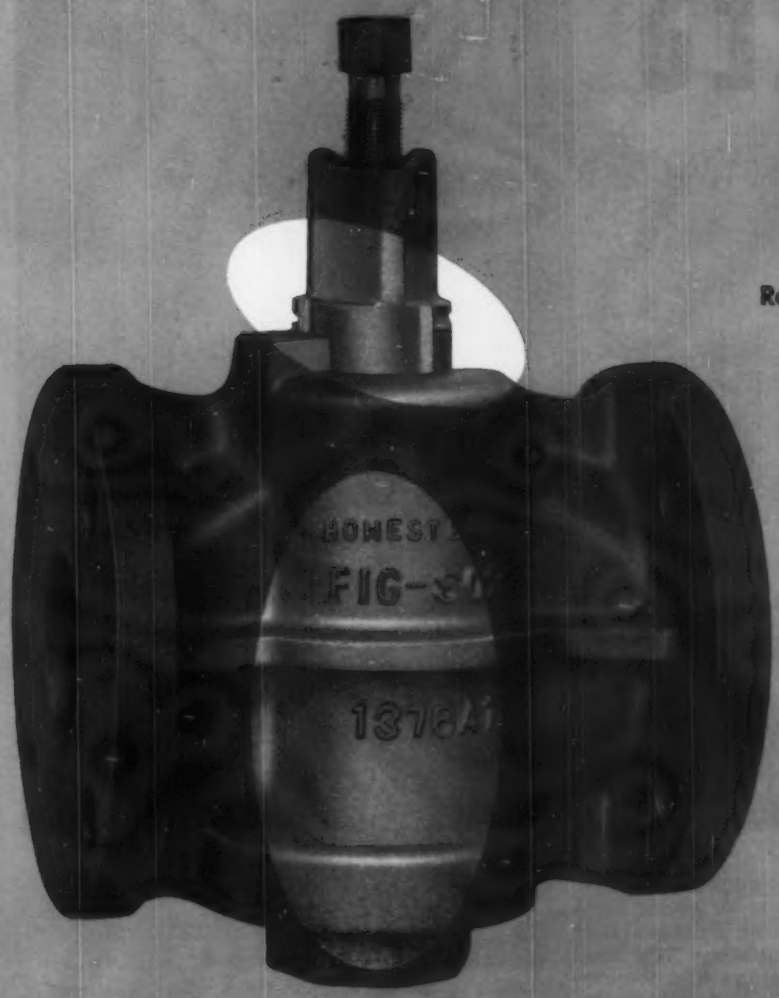
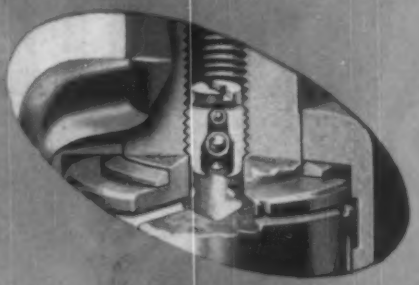
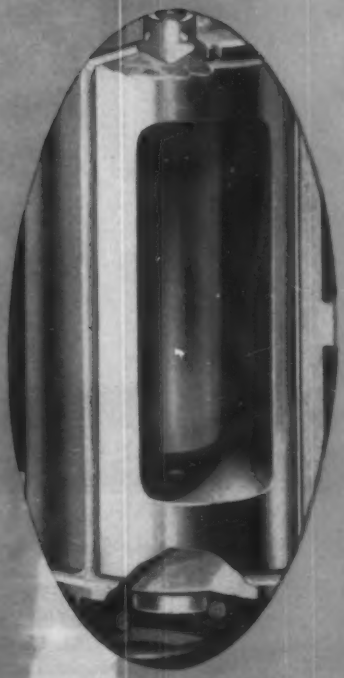




Reinforced Teflon and lubricant seal



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Homestead's controlled lubricating system forces a chemical film over all sealing surfaces at more than 300 pounds pressure. In addition, it prevents sticking, by its piston-like movement of the plug during each lubrication. See how Homestead fills your valve needs. Write today for Reference Book 39, (Section 5), for complete information on Homestead Lubricated Plug Valves.

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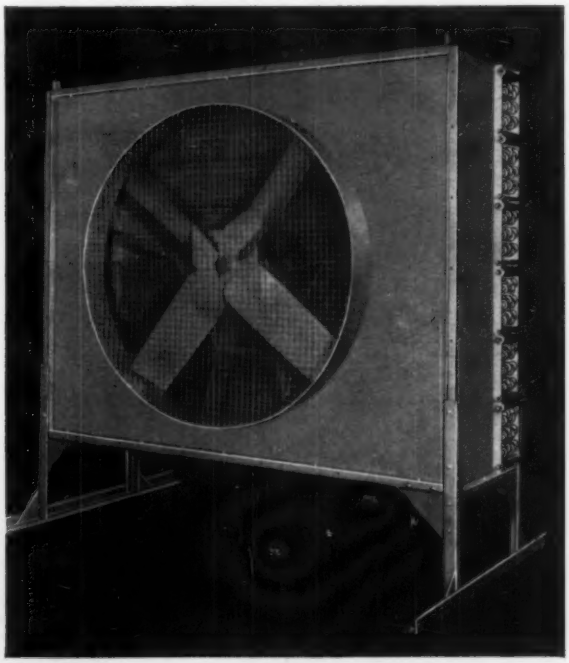

McQuay **"AB" Belt Drive AIRCON**

Remote, waterless condensers available in eight sizes, 9, 11, 15, 20, 25, 30, 40 and 50 ton nominal capacities in individual units with single fan and motor assemblies. Coils constructed of copper tubes with McQuay Ripple Fins. Lifetime ball bearing and slow speed propeller type fan.

McQUAY AIRCON *Air Cooled Condensers*

Here is the finest, the most complete, most versatile, the most efficient line of remote air cooled condensers on the market, as well as the largest available in a single unit. There are eight McQuay "AB" Belt Drive AIRCON Air Cooled Condensers from 9 to 50 ton nominal capacities. McQuay also offers the "AD" Direct Drive AIRCON Line of Air Cooled Condensers in 2, 3 and 5 ton nominal capacities. All McQuay AIRCONS are designed for multiple circuiting so that two or more separate refrigeration systems can be connected to the same condenser.

PEAK PERFORMANCE ALL YEAR 'ROUND WITH "SEASONTROL" MODULATION.

The McQuay "Seasontrol" modulates the condenser capacity in accordance with the weather for proper operation at all times. There is a McQuay representative in every principal city, or write McQuay, Inc., 1601 Broadway St., N.E., Minneapolis 13, Minn.

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EVAPORATOR PRESSURE REGULATORS

Alco Evaporator Pressure Regulators accurately maintain evaporator pressure in either a single or multiple system, guaranteeing highest evaporator efficiency regardless of load changes.

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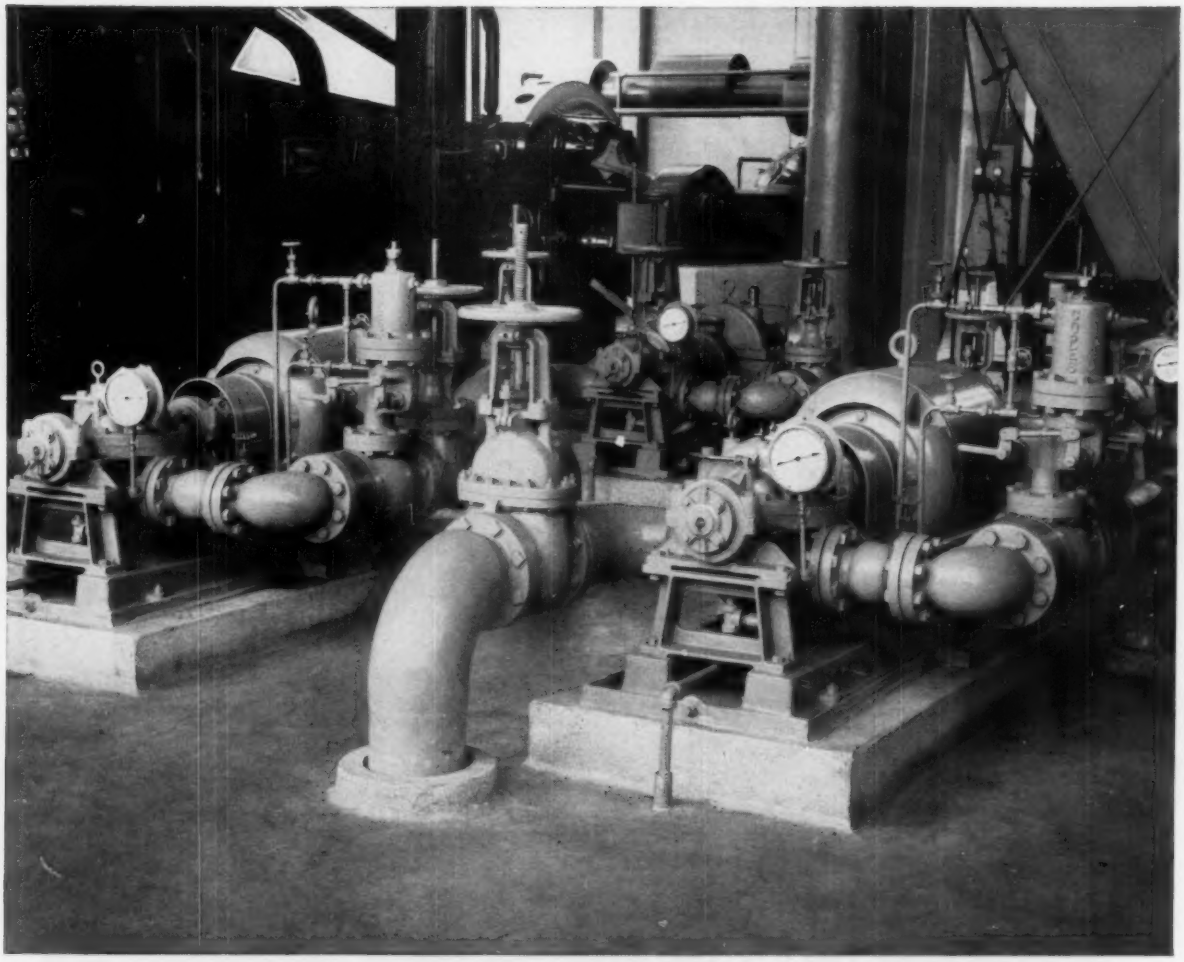
The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributor Solenoid Valves • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves



"Buffalo" Type RR Pumps on boiler feed at a large auto plant

"BUFFALO" – THE PUMPS THAT DON'T MIND BEING IN HOT WATER AND UNDER PRESSURE!

In selecting boiler feed pumps of both peak efficiency and year-after-year durability, under pressure, pick the make with the 80-year record for these characteristics — "Buffalo". This long experience in designing and building centrifugal pumps for industry has resulted in present-day "Buffalo" Pumps with every feature for maximum delivery at least power input — and for continuous service with negligible maintenance.

"Buffalo" Type RR two-stage and four-stage pumps have the typically efficient, balanced "Buffalo" impellers — the oversize bearings and shafts — the rugged casings with simply formed water passages and deep 8-ring stuffing boxes. Write for Bulletin 980 and see why we say there's no better buy!

Boiler feed pumps for pressures to 500 psi

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This free catalog for 1958 illustrates and gives complete specifications of NIBCO low pressure, pressure rated and special type bronze valves . . . including the sensational new Y-Pattern Globe and Check Valves. These are the valves that give you more shut-offs per dollar . . . fully guaranteed to operate perfectly. See your wholesaler or send coupon below.

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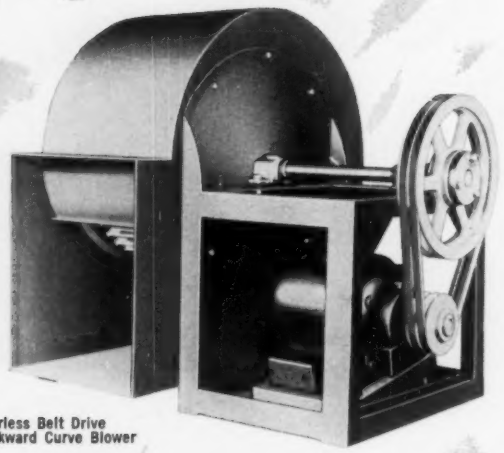

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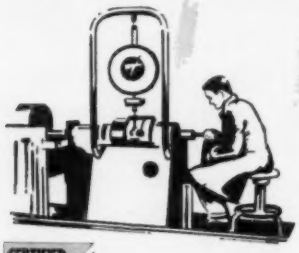

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Write today for Bulletins SDA-160, SDA-200 and SDA-220!

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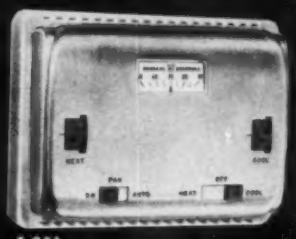

T-231
TWO-STAGE HEATING AND COOLING

T-99
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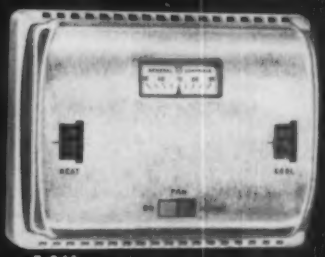
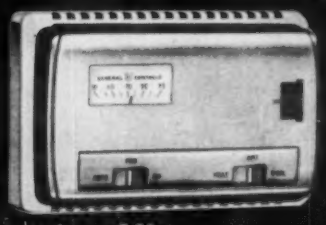
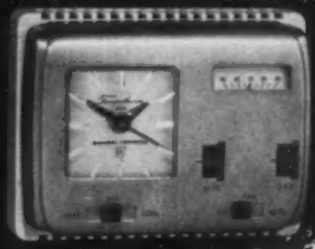
Optional Fan Control



T-241
TWO-STAGE HEATING AND COOLING
Automatic System Changeover



T-90
YEAR 'ROUND HEATING-COOLING



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CLOCK CONTROLLED DAY-NITE, HEATING-COOLING

AMERICA'S MOST COMPLETE LINE OF AIR CONDITIONING THERMOSTATS!

118 FUNCTION VARIATIONS TO CONTROL *ANY* SYSTEM

- COOL, HEAT, FAN, AUTO, OFF, RESET SWITCHING FUNCTIONS
- SINGLE OR TWO-STAGE HEATING WITH SINGLE OR TWO-STAGE COOLING
- HEAT AND COLD ANTICIPATION
- DAY AND NITE CLOCK PROGRAMMING
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For control of gas, oil, coal, electricity refrigeration, evaporative, chilled water and heat pump systems.

General Controls continues to set the pace in creating the kind of *advanced design* thermostats that afford the systems engineer maximum selectivity in air conditioning thermostats. Not only do General Controls thermostats please the homeowner by their beauty and simplicity of line, they also signify *quality* – and prove it by delivering the top performance engineered into systems and related equipment.

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You design it . . . we'll control it . . . *automatically.*

5 basic styles harmonize with any architectural or decorating theme

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America's Finest Automatic Controls for Home, Industry, and the Military

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Five Plants — 22 factory branch offices serving the United States and Canada

Air conditioned with without loss of

London Guarantee Building was completed in 1923, air conditioned with TRANE equipment in 1957. Leslie H. Klawans and Company, Management Agent. Architects and engineers for the remodeling job were Robert E. Hattis Engineers, Inc. Heating and refrigeration contractor was Advance Heating and Air Conditioning Corporation. Ventilation contractor was Narowetz Heating and Ventilating Company, all of Chicago.

Trane equipment rental-income space

Year-around air conditioning system installed with almost no disturbance of tenants

The building: London Guarantee Building, 360 North Michigan Avenue, Chicago, Ill.—with 200,000 square feet of rentable office space.

The problem: *Ten* exterior exposures gave this building a large percentage of exterior space. Each floor is divided about 80% exterior offices and suites; 20% interior office areas. Problem was to install complete, year-around air conditioning in as short a time as possible . . . with a minimum of disturbance to tenants . . . and as economically as possible with respect to both space and dollars.

The solution: TRANE equipment met all the above requirements and the building owners didn't lose any income due to space loss. 918 TRANE Fan-coil Uni-Trane units—each with outside air intakes to meet Chicago code—were installed in all exterior spaces to provide individual climate control. Installation was made on a module basis for maximum flexibility in meeting future remodeling requirements.

The twenty interior zones (one for each floor) were conditioned with TRANE Climate Changers. These units were installed in an abandoned elevator shaft, so required no rentable space. The main refrigeration equipment (two TRANE CenTraVacs) was installed in the existing boiler room.

The entire air conditioning job was completed in six months' time, with air conditioning available to tenants on June 1, 1957.

In planning air conditioning for new or existing buildings, more and more architects and engineers are turning to TRANE equipment. There are TRANE units for any kind of building, any type of system. And TRANE *matched* equipment works together to save space, cut costs, speed installation. Have your architect or consulting engineer call your nearby TRANE Sales Office or write TRANE, La Crosse, Wisconsin.

For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

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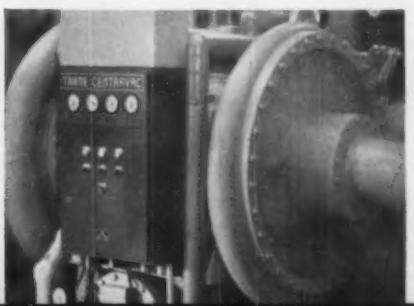
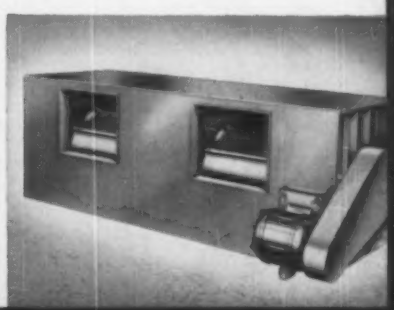
918 Fan-coil UniTrane units provide individual climate control for London Guarantee Building. Units are installed on a module basis to permit flexibility for future tenant remodeling. TRANE Fan-coil units were chosen for their ease in converting existing steam heating system to hot water for heating, chilled water for cooling.

Two TRANE CenTraVacs, hermetic centrifugal compressors, supply chilled water for summer cooling. CenTraVacs were installed in the existing boiler room. Operation of CenTraVac is *automatic*—unit paces itself to supply just the amount of refrigeration needed . . . modulates down to 10% of full load capacity or lower.



Twenty TRANE Climate Changers condition the air for open office areas in London Guarantee Building. Installed in an unused elevator shaft, Climate Changers required no rentable space. Available in single zone or multi-zone models, Climate Changers heat, cool, ventilate . . . meet a variety of air conditioning requirements.



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genetron® SUPER-DRY REFRIGERANTS

Selected Physical Data
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	Trichloromonofluoromethane	Dichlorodifluoromethane	Monochlorodifluoromethane	Trichlorotrifluoroethane	Dichlorotetrafluoroethane
	genetron 11 ORANGE LABEL	genetron 12 WHITE LABEL	genetron 22 GREEN LABEL	genetron 113 PURPLE LABEL	genetron 114$_A$ DARK BLUE LABEL
Chemical Formula	CCl_3F	CCl_2F_2	$CHClF_2$	$C_2Cl_3F_3$	$C_2Cl_2F_4$
Molecular Weight	137.4	120.9	86.5	187.4	170.9
Boiling Pt. (°F) at 1 Atm. Pressure	74.7	—21.6	—41.4	117.6	37.6
Evaporator Pressure at 5°F (p.s.i.g.)	24.0*	11.8	28.3	27.9*	15.6*
Condensing Pressure at 86°F (p.s.i.g.)	3.6	93.3	159.8	13.9*	22.7
Freezing Point (°F) at 1 Atm. Pressure	—168	—252	—256	—31	—76
Critical Temperature (°F)	388	234	205	417	294
Critical Pressure (p.s.i. absolute)	635	597	716	495	478
Compressor Discharge Temperature (°F)	112	101	131	86	88
Compression Ratio (86°F/5°F)	6.24	4.08	4.06	8.02	5.33
Specific Volume of Saturated Vapor at 5°F (cu. ft./lb.)	12.27	1.46	1.25	27.04	4.04
Latent Heat of Vaporization at 5°F (B.t.u./lb.)	84.0	68.2	93.6	70.6	60.2
Net Refrig. Effect of Liquid—86°F/5°F (B.t.u./lb.)	67.5	50.0	69.3	53.7	43.0
Specific Heat of Liquid at 86°F (B.t.u./lb.°F)	0.21	0.24	0.34	0.22	0.23
Specific Heat of Vapor at Constant Pressure of 1 Atm. & 86°F (B.t.u./lb.°F)	0.13	0.15	0.15	0.15	0.16
Specific Heat Ratio at 86°F & 1 Atm. (k = Cp/Cv)	1.14	1.14	1.18	1.09	1.01
Coefficient of Performance	5.09	4.70	4.66	4.92	4.60
Horsepower/Ton Refrigeration	0.927	1.002	1.011	0.960	1.025
Refrigerant Circulated/Ton Refrig. (lbs./min.)	2.96	4.00	2.89	3.73	4.65
Liquid Circulated/Ton Refrig. (cu. in./min.)	56.0	85.6	68.0	66.5	88.7
Compressor Displacement/Ton Refrig. (c.f.m.)	36.32	5.83	3.60	100.76	18.78
Toxicity (Underwriters' Laboratories Group No.)	5A	6	5A	4-5	6
Flammability & Explosivity	None	None	None	None	None

*Inches of mercury vacuum.

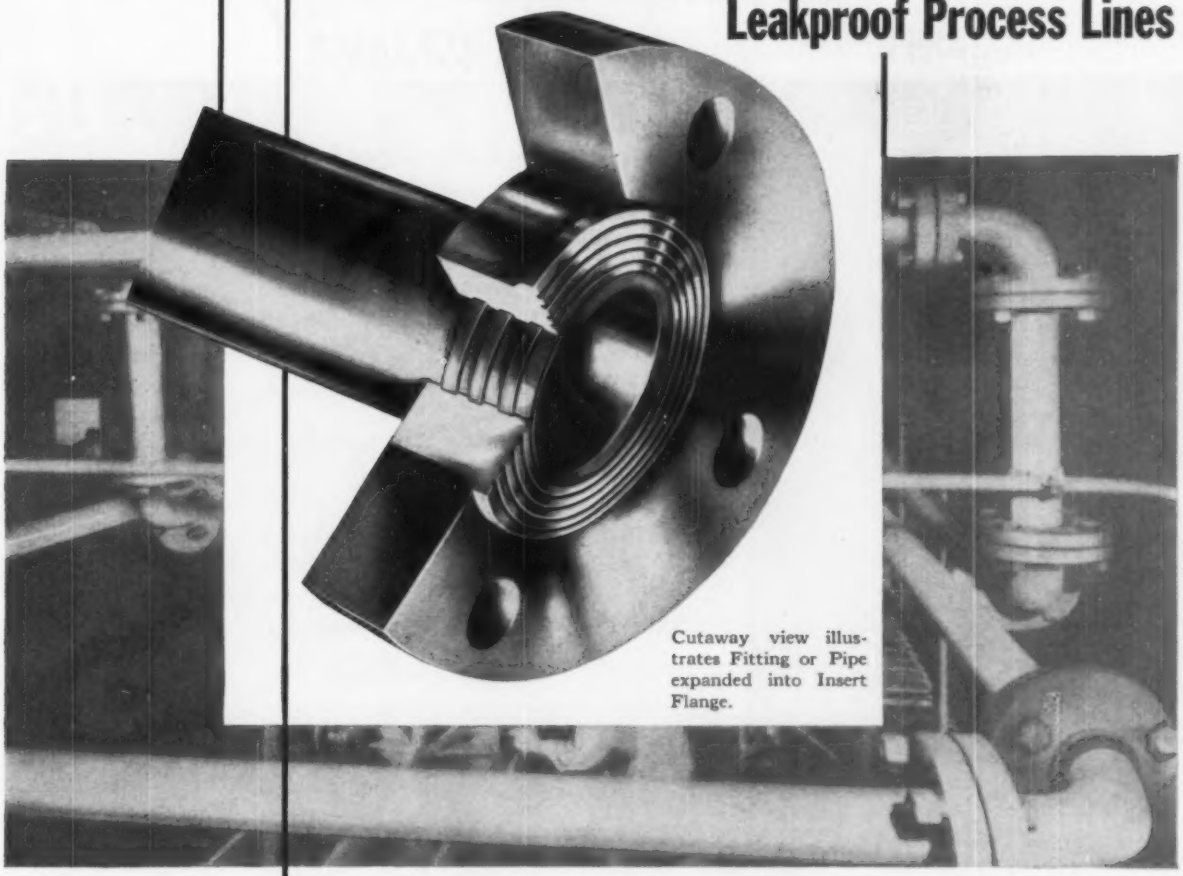
COMPARE! Careful control at every step in the manufacture of "Genetron" Super-Dry Refrigerants results in products of highest purity, which are extremely low in moisture content and other undesirable impurities. Quality of current production consistently *surpasses* the rigid manufacturing specifications for these products. Write for important informative folder "Genetron Super-Dry Refrigerants."

SEE YOUR WHOLESALER
or write or call
genetron DEPARTMENT
GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

GC Allied Chemical

NOW...FLANGE WITHOUT WELDING

for Faster, Lower Cost Assembly of Leakproof Process Lines



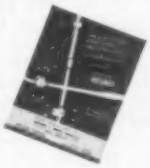
Cutaway view illustrates Fitting or Pipe expanded into Insert Flange.

Speedline Insert Flanges provide leakproof joints—*without welding*—and maintain the high quality control standards required for the most complex processes.

"With Speedline Insert Flanges, we have stainless steel bonded to stainless steel, rolled in under pressure for a permanently leakproof installation of transfer and manifold lines", reports Plant Engineer at a Chicago plant.

The "tangential" feature, exclusive with all Speedline formed fittings, allows for direct attachment of Insert Flanges by simple expanding operation.

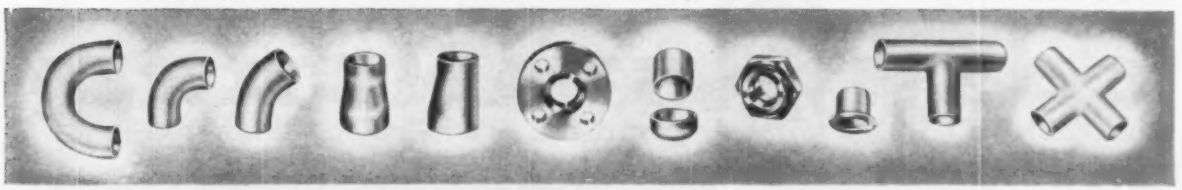
Learn how the complete line of Speedline corrosion resistant fittings assure piping economy and efficiency not possible with conventional fittings. Write for a copy of "Speedline Catalog" today.



Speedline®

SPEEDLINE IS A REG.T.M. OF HORACE T. POTTS COMPANY

STAINLESS STEEL FITTINGS SPEEDLINE DISTRIBUTORS ARE LOCATED IN PRINCIPAL CITIES

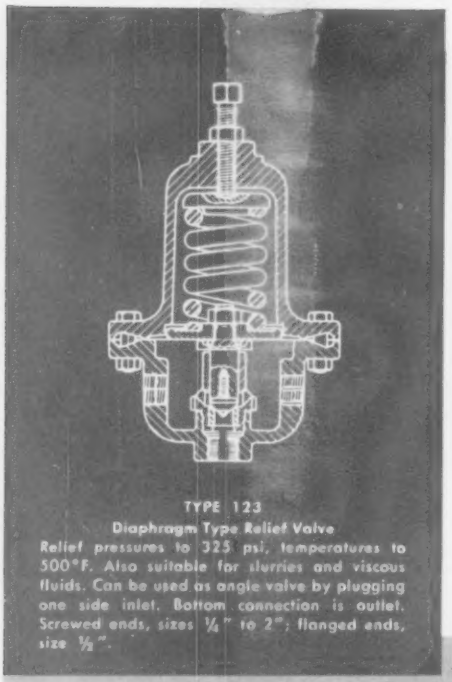


Manufactured by **HORACE T. POTTS COMPANY** • 576 E. Erie Avenue • Philadelphia 34, Penna.

back pressure control problem?

CASH STANDARD

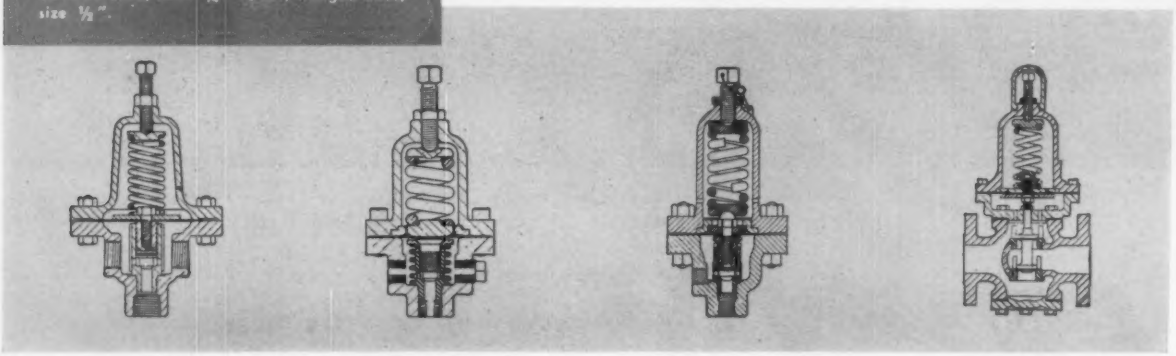
has the answer!



TYPE 123
Diaphragm Type Relief Valve
Relief pressures to 325 psi, temperatures to 500°F. Also suitable for slurries and viscous fluids. Can be used as angle valve by plugging one side inlet. Bottom connection is outlet. Screwed ends, sizes ¼" to 2"; flanged ends, size ½".

- **for relief pressure ranges from vacuum to 3000 psi**
- **available in iron, bronze, steel, stainless steel**
- **for almost all liquids and gases**
- **sizes from ¼" to 4"**
- **self contained, direct operated units**

Designed for any application where back pressure regulation is required. Also available in differential style to maintain differential pressure between fluids on both sides of the diaphragm.



TYPE BQ
Diaphragm Type Relief Valve
Relief pressures to 250 psi, temperatures to 450°F. A small valve especially for jobs requiring accuracy with low volume of flow. Can be used as angle valve by plugging one side inlet. Screwed ends, sizes ¼", ⅜" and ½".

TYPE 6987
High Pressure Relief Valve
Relief pressures to 1200 psi. Screwed ends, sizes ½" and ¾"; flanged ends, size ½".

TYPE 2275
Angle Type High Pressure Relief Valve
Relief pressures to 3000 psi. Side inlet, bottom outlet. Screwed ends, sizes ½", ¾", 1" and 1½".

TYPE 8311
Pressure Relief Valve
Relief pressures to 500 psi. Packless, direct operated. Single or double seat construction. Screwed ends, sizes ½" to 3"; flanged ends, sizes 1" to 4".

What's your control problem?

Consult the Cash Standard control specialist in your area for an individual solution to your control problem or write to Dept. B.

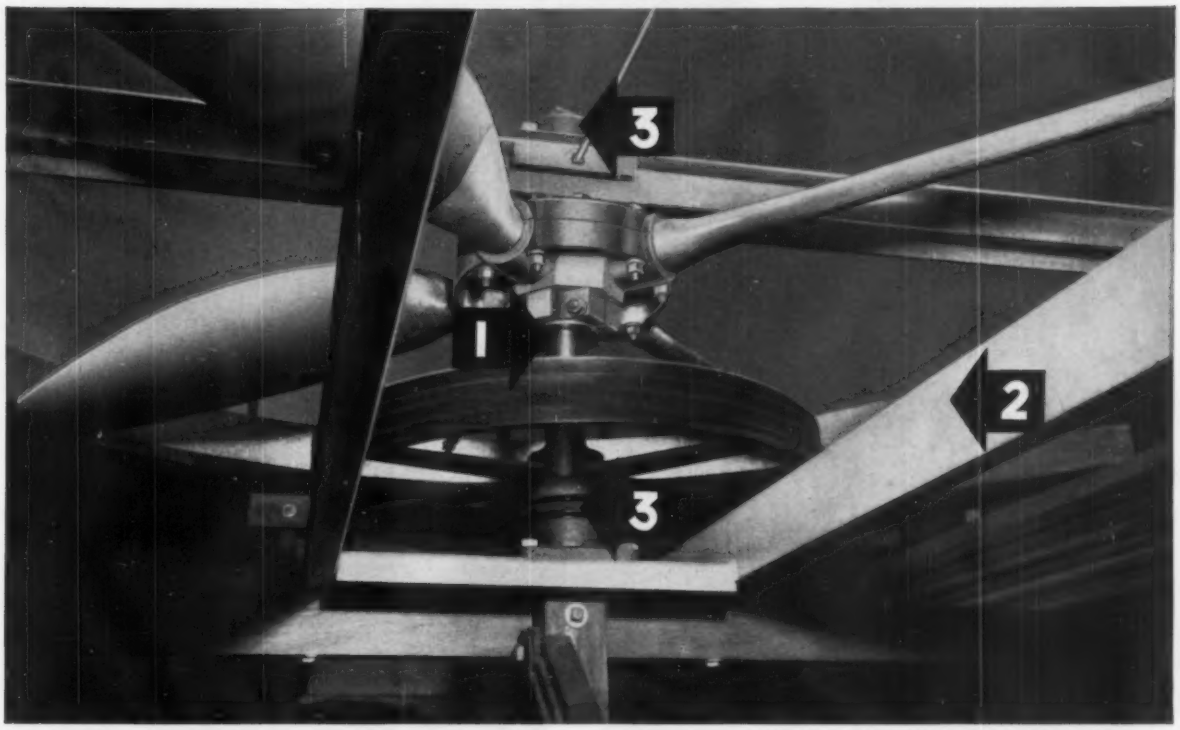
CASH CS **STANDARD**

A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
P. O. Box 551, Decatur, Ill.

Pressure, Hydraulic, Temperature, Process and Combustion Controls

THE Pritchard LOLINE®

HAS MECHANICAL FEATURES THAT ADD UP TO LONGER LIFE, TROUBLE-FREE OPERATION



TEFC MOTORS . . . totally enclosed, fan cooled motors are standard equipment on both Series "B" (8′ high) and Series "R" (12′ high) LoLine towers. They require no additional enclosure or protection against weather.

❶ **STAINLESS STEEL FAN SHAFT . . .** on multi V-belt drive, eliminates costly corrosion problems and hazards of fan shaft breakage.

❷ **HOT-DIP GALVANIZING . . .** all steel parts are hot-dip galvanized after fabrication. The one proven method to successfully stop rust and corrosion.

❸ **OVERSIZED BEARINGS . . .** factory sealed and widely separated to reduce bearing load. Bearings on multi V-belt drive have grease fittings brought to outside of fan ring for easy, safe lubrication.

SPEED REDUCER DRIVE (Standard on Series "R")...uses spiral bevel gear rated by AGMA methods and built specifically for cooling tower service, assuring adequate size for duty.

DRIVE SHAFT FOR REDUCER (Standard on Series "R") . . . is full floating, non-lubricated with stainless steel, flexible discs for longer life. All of these mechanical features found in the LoLine cooling tower add up to maximum performance and years of trouble-free service.

Whether It's for Air Conditioning Use or Industrial Service You Get More for Your Cooling Tower Dollar with a Pritchard LoLine

ALL THE FACTS AT YOUR FINGERTIPS

Get all the facts on the outstanding Pritchard LoLine Cooling Towers . . . including complete engineering data . . . by writing today on your company letterhead for the new, LoLine Bulletin (No. 5.1.902). This unique brochure gives you all the information you will want in one convenient source. Write for your FREE copy today!

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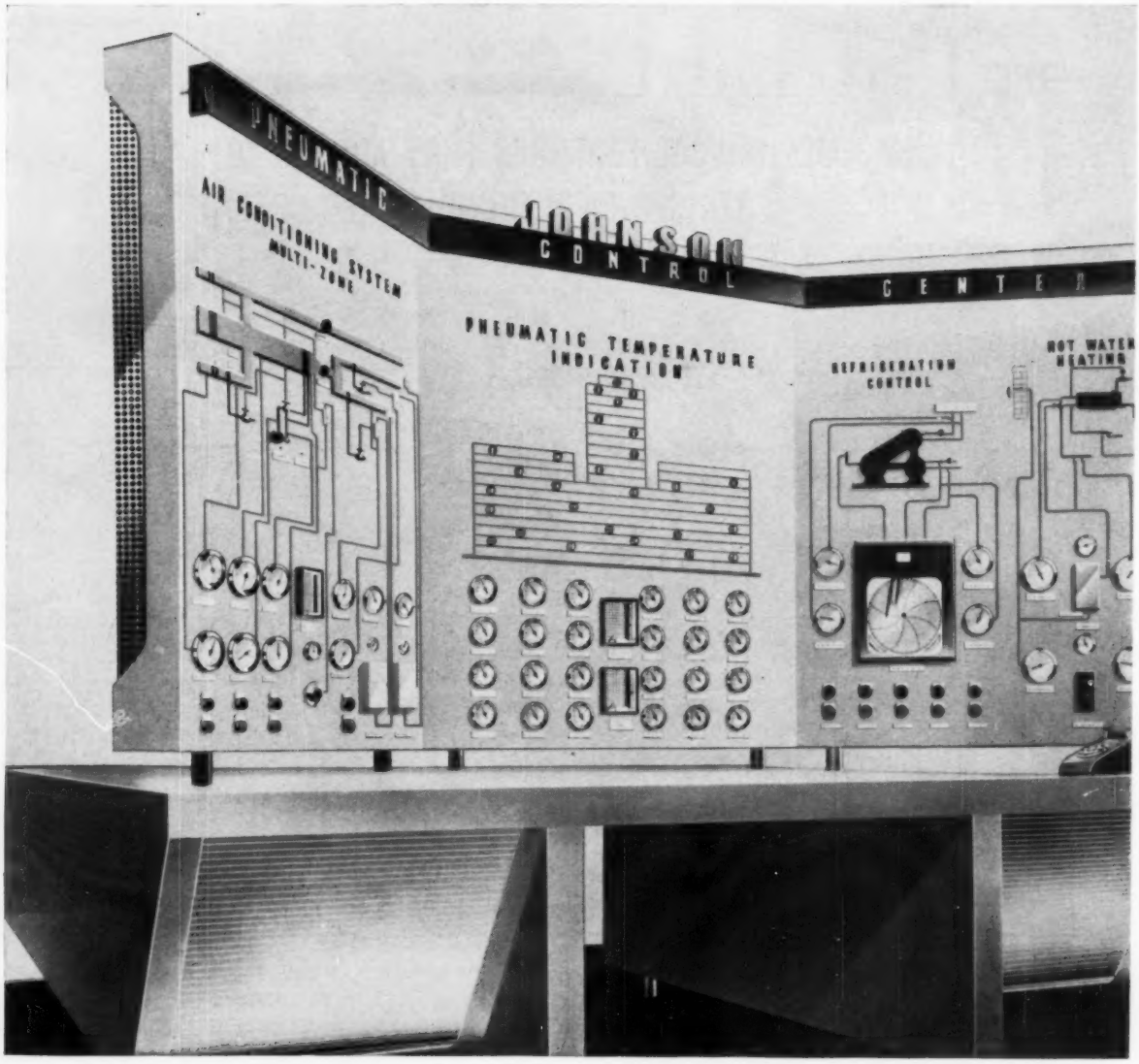


Add the Final Touch of Magic

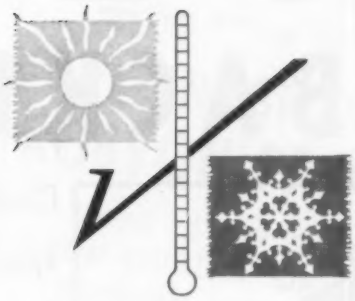
JOHNSON PNEUMATIC CONTROL CENTERS

Perfection of the Pneumatic Control Center by Johnson is bringing major savings in heating and cooling costs as well as greatly improved temperature control to buildings of all types and sizes.

The Johnson Pneumatic Control Center gives the building engineer *centralized* supervision and regulation of the air conditioning and heating system. It provides him with a *continuous,* comprehensive visual display of all the vital operating data necessary to maintain the exact temperature conditions required. Simultaneously, it assures that all components of the system constantly function at peak efficiency.

A GLANCE TELLS ALL

By simply scanning the panel, for example, the operator can check space temperatures and water and air supply temperatures at strategic control points throughout the system. *Equally important, he can make any necessary adjustments of key temperatures instantly, right at the panel!*



Sizes, layouts and styles of Johnson Pneumatic Control Centers depend upon the specialized needs of the individual building. Each is planned separately with the building's engineer and architect.

to Your Air Conditioning!

ONE MAN DOES EVERYTHING

Thus, the operation of even the most complex air conditioning and heating systems is reduced to a one-man job! Instead of an operating *crew* checking performance and making adjustments at widely scattered locations, one man does it all from the panel! In effect, he can be in 20 or 30 or more places at once!

This coordinated, unerring control assures a uniformly ideal environment to meet every comfort and work requirement of any modern building. It results in large reductions in fuel and power consumption and prolongs equipment life.

Remarkably easy to understand and operate, the Pneumatic Control Center requires no extensive study or training. Its components are as simple and inexpensive to use and maintain as the pneumatic controls used elsewhere in the building. Dramatic styling adds an exciting architectural asset when the Center is located in public view.

ECONOMIC ADVANTAGES IMPRESSIVE

What the Pneumatic Control Center means in terms of greater comfort, manpower savings and more efficient heating and air conditioning performance is obvious. It not only pays for itself in a hurry, but it keeps right on paying off over the life of the building!

Pace-setting Johnson Pneumatic Temperature Control Systems with Control Centers are now being installed in many of the nation's finest offices, stores, hotels, hospitals, industrial plants, schools and public buildings. Before you build or modernize, ask your local Johnson branch for full details or write Johnson Service Company, Milwaukee 1, Wisconsin.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

ROBVON
BACKING RINGS

Patent Nos.
Type C Reg Pat
No. 2,366,579
Type CC & CCC Reg Pat. No. 2,764,426

Designed to meet the most exacting specifications.

Designed to furnish the most highly efficient welded joint possible and to pass the most critical inspection.

Designed to save on fit-up and cut welding costs.

Type CCC Designed for quick easy alignment of pipe where the variation in inside diameters is relatively great. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. ROBVON rings are beveled to assure non-restricted fluid flow.

Type CC Designed to allow quick easy alignment of pipe where the inside diameters are slightly out of round. The welder has the choice of "STRIKING OFF" the NUBS or leaving them intact to be melted into the weld mass of the first root pass.

Type C Designed for precise close tolerance fit-up. Type "C" NUBS conform to the diameter of the weld root. The NUBS melt with the metal to give complete penetration and fusion.

PLEASE NOTE CAREFULLY . . .

Our last advertisement was in error

Please tear out and insert at page 88 of your January issue

All Robvon Backing Rings are available in carbon steel, wrought iron, 1% chrome ½% moly, 1¼% chrome ½% moly, 2¼% chrome 1% moly, 4/6% chrome ½% moly, stainless steel, and aluminum.

Write us today for more information.

ROBVON
BACKING RING COMPANY

675 GARDEN STREET **ELIZABETH, N. J.**

chosen for these exacting installations

ROBVON BACKING RINGS

available through the leading welding fittings distributors.

INSIST ON ROBVON PRODUCTS

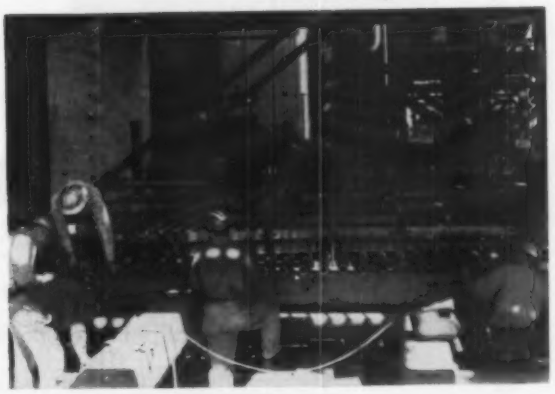
THERE IS NO SUBSTITUTE FOR QUALITY OR SERVICE, ROBVON INSURES BOTH.

Write for full details and the names of your local ROBVON distributors.

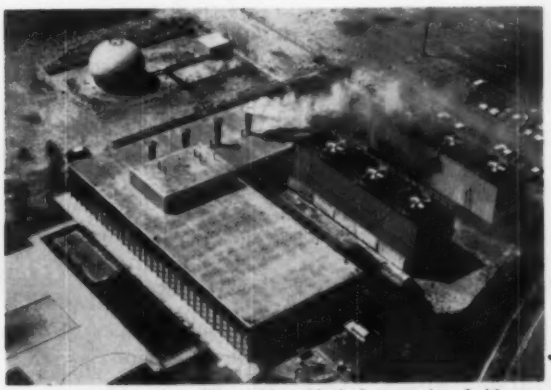
ROBVON BACKING RING CO.
675 Garden Street **Elizabeth, N. J.**

Tower, Pools & Central Heating Plant New York International Airport. Courtesy—The Port of New York Authority

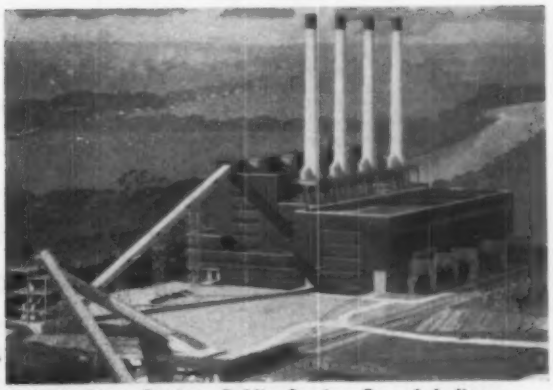
U. S. S. Nautilus. Courtesy—Electric Boat Division, General Dynamics Corp.



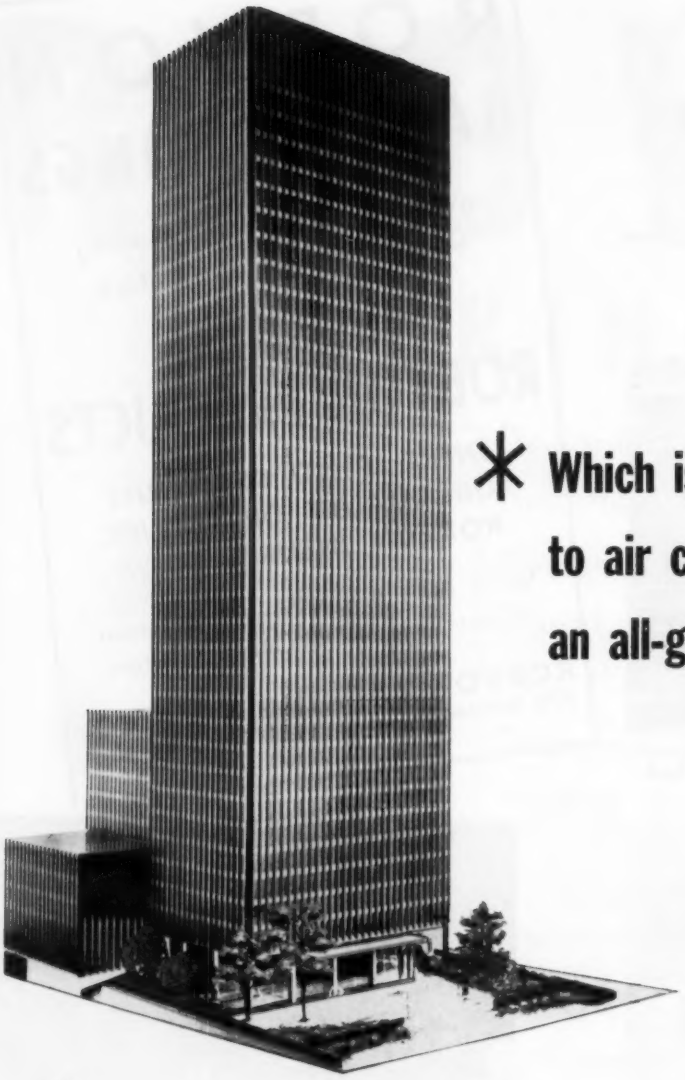
Courtesy—Foster Wheeler Corp.



Central Heating Plant, New York International Airport. Courtesy—The Port of New York Authority



Wabash River Station, Public Service Co. of Indiana, Foster Wheeler Corp. Boilers



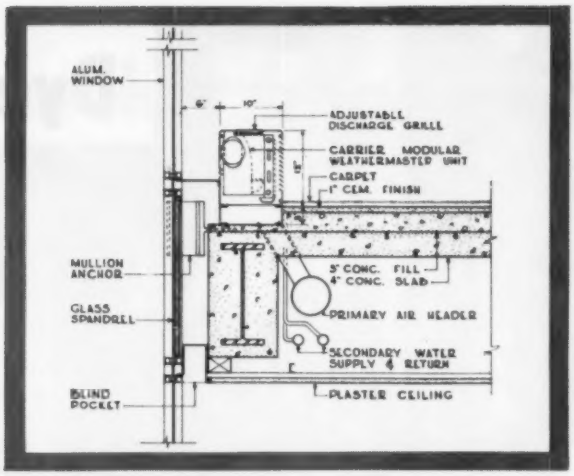
✳ Which is the best way to air condition an all-glass building?

That depends on the building. For example, its fenestration and construction are important factors in selecting individual air conditioning units. Carrier meets every variation of these factors with its flexible new Modular Weathermaster* Units. Based on the "building block" principle, they adapt attractively and efficiently to all conditions, provide individual climate control in each room. Only Carrier makes modular units to fit any all-glass building problem. Here are six different modular arrangements—there are many more. For complete information about them, call your nearest Carrier office.

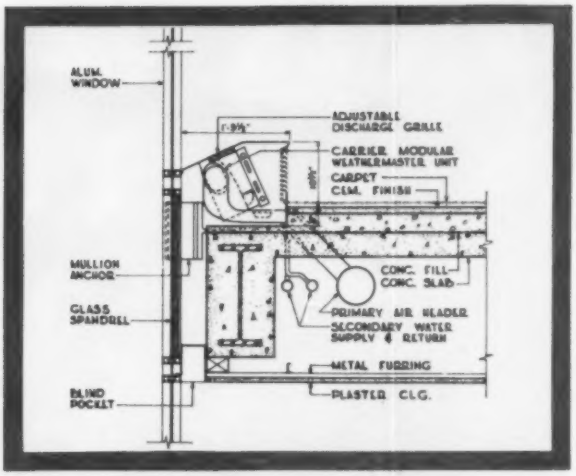
Carrier

*Reg. U.S. Pat. Off.

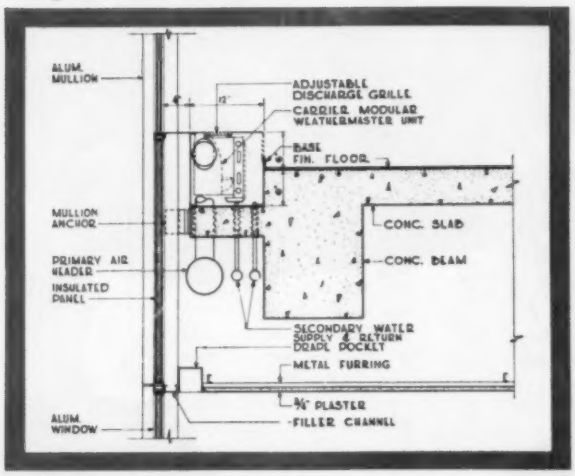
For free booklet describing Carrier Modular Weathermaster Units, ask your nearest Carrier office for 36N-64. Or write Carrier Corporation, Syracuse, New York.



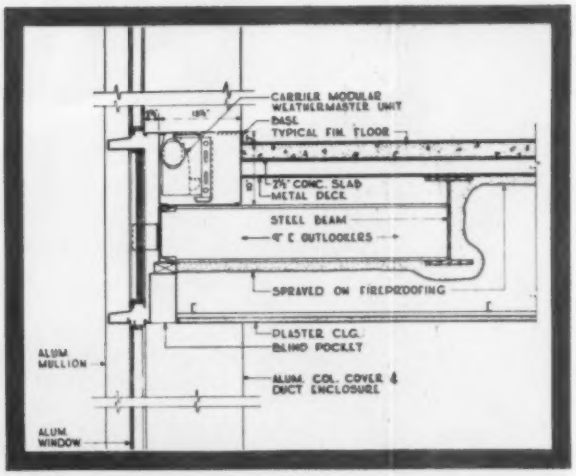
TYPICAL INSTALLATION WITH STOOL POCKET



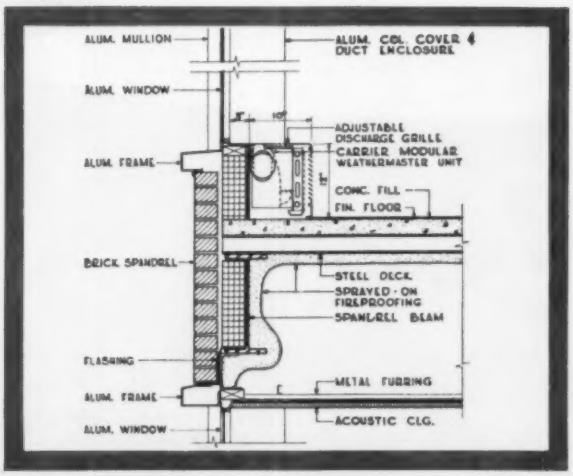
TYPICAL INSTALLATION WITH SLOPING STOOL



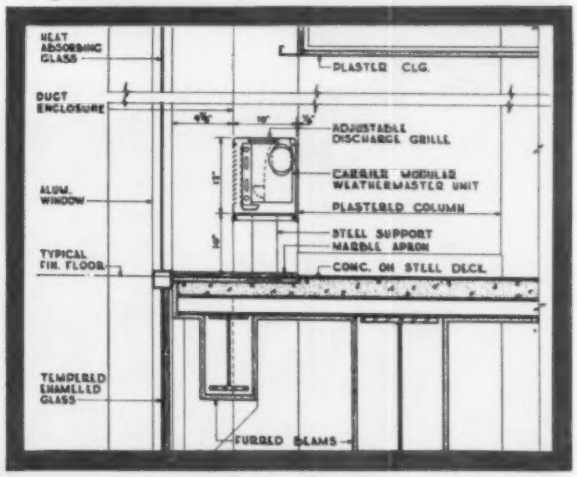
TYPICAL SEMI-RECESSED INSTALLATION



TYPICAL RECESSED INSTALLATION

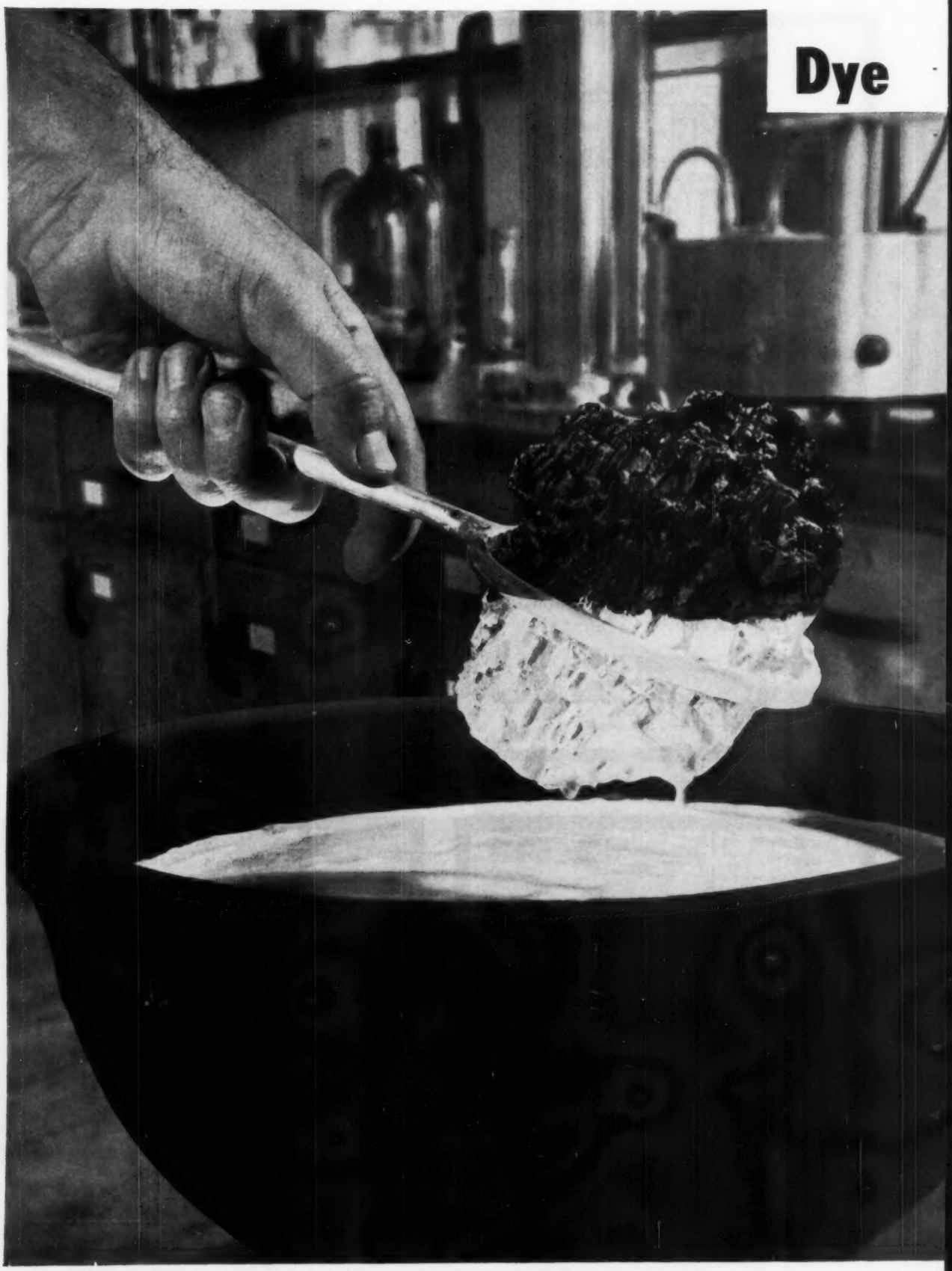


TYPICAL SURFACE INSTALLATION



TYPICAL RAISED INSTALLATION

Air and water services to individual Carrier Modular Weathermaster Units may be run horizontally from vertical risers, or they can be fed vertically from sources running horizontally in the ceiling below.


Dye

maker brightens fuel cost picture

Burning coal at Toms River-Cincinnati saves 20% on fuel costs, permits clean steam generation

The Toms River-Cincinnati Chemical Corp. plant in Toms River, N.J. is the most modern plant of its kind in the world. Producing vat dyestuffs requires a large dependable steam supply for chemical processes and heating purposes. To fill these requirements, the power plant at Toms River-Cincinnati is as up-to-date and efficient as the general plant itself. The fuel used for steam generation is *coal* because, on the basis of cost per thousand pounds of steam, the nearest competitive fuel costs 20% more than coal. In addition, thanks to automatic operation and modern equipment, the power plant meets the rigid standards of cleanliness required in such manufacturing operations.

Facts you should know about coal

Not only is bituminous coal the lowest-cost fuel in most industrial areas, as in the case of Toms River-Cincinnati, but up-to-date coal burning equipment can give you 15% to 50% more steam per dollar. Today's automatic equipment pares labor costs and eliminates smoke problems. And vast coal reserves plus mechanized production methods mean a constantly plentiful supply of coal at stable prices.

Technical advisory service

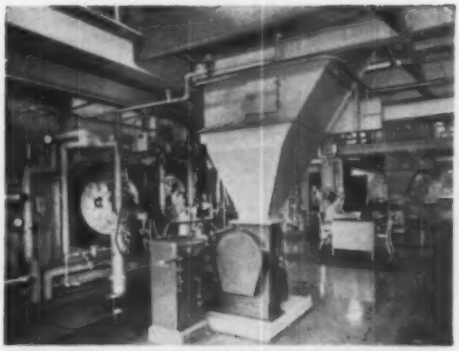
The Bituminous Coal Institute offers a free technical advisory service on industrial fuel problems. We welcome the opportunity to work with you, your consulting engineers and architects. If you are concerned with steam costs, write to the address below. Or send for our case history booklet, complete with data sheets. You'll find it informative.

Consult an engineering firm

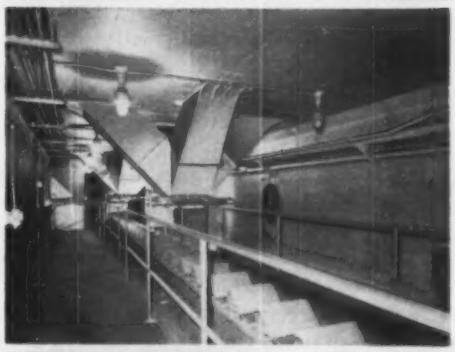
If you are remodeling or building new heating or power facilities, it will pay you to consult a qualified engineering firm. Such concerns—familiar with the latest in fuel costs and equipment—will effect great savings for you in efficiency and fuel economy over the years.

BITUMINOUS COAL INSTITUTE

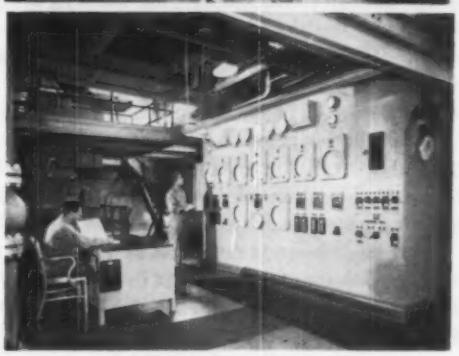
Southern Building • Washington 5, D. C.



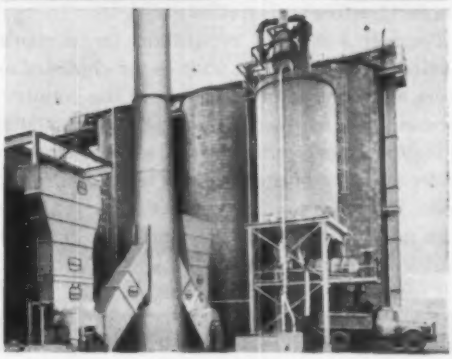
View of boiler room showing both 50,000 lbs. hr. boilers, by Riley Stoker Corp. Each has two burners. Center foreground is automatic weigh scale, by Richardson Scale Co., which receives coal through hopper from live storage bin and passes it to coal feeder. Coal is fed to Riley Pulverizer in basement, then blown back up to burners.



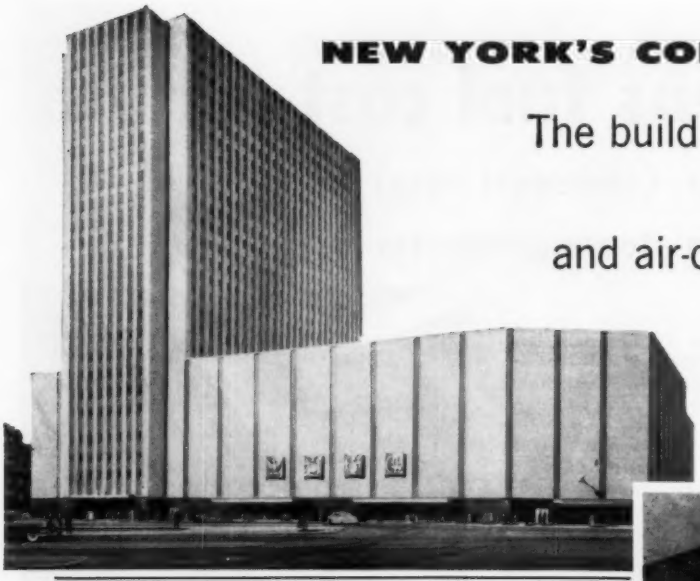
Close-up of Gifford-Wood Roundabout Bucket Conveyor beneath coal storage silos. Transversing feeder-car is used when coal is emptied from silo and conveyed to live storage bin.



Automatic combustion control and instrument panel by Bailey Meter Co.



Fly ash being loaded on truck through a dustless rotary unloader. Fly ash is collected by Prat-Daniel Mechanical Precipitators. A pneumatic ash collecting system by United Conveyor (with tie-ins under air heater and at base of stack) removes it to this 20-ton ash silo. In the rear are three 330-ton coal silos.



NEW YORK'S COLISEUM—

The building that "has everything"
has heating
and air-conditioning systems of

NATIONAL PIPE

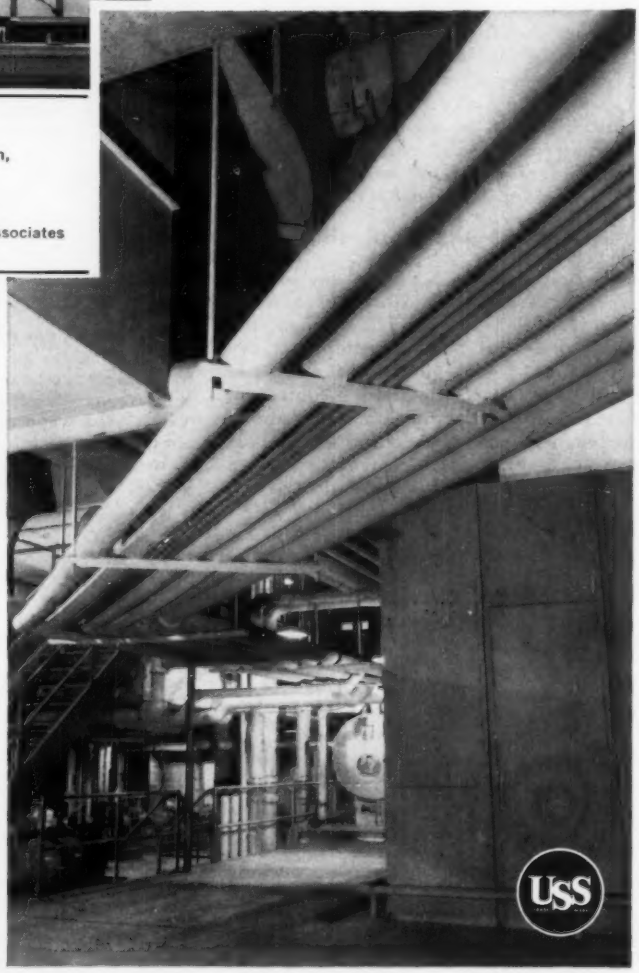
OWNER: Triborough Bridge & Tunnel Authority
ARCHITECTS: Leon & Lionel Levy
CONSULTING ARCHITECTS: Eggers & Higgins, John B. Peterkin, Aymar Embury III
GENERAL CONTRACTOR: Walsh-Fuller-Slattery
HEATING & AIR CONDITIONING: Almirall & Company, Inc.
MECHANICAL & ELECTRICAL ENGINEERS: Guy B. Panero Associates
STRUCTURAL ENGINEER: Dr. Jacob Feld

New York City's Coliseum is one of the most distinctive and functional structures ever conceived. Its 26 floors and giant exhibition hall comprise an auditorium area capable of seating over 10,000 persons, approximately 1,000,000 sq. ft. of usable floor space, and an 850-car underground garage. Except for the garage, the building is completely air conditioned.

More than 376 tons of National Pipe were used in the heating and air-conditioning systems of the new structure. The office building area requires 1,500 tons of refrigeration; the Coliseum proper requires 2,500 tons. Four compressors supply 4,000 tons of refrigeration for the high-pressure air-conditioning system.

Purchased steam is delivered at 125 to 150 psi. Pressure-reducing rigs reduce it to 50 psi and 5 psi for distribution throughout the buildings. Steam requirements are about 102,000 lbs. per hour for comfort heating and auxiliary uses.

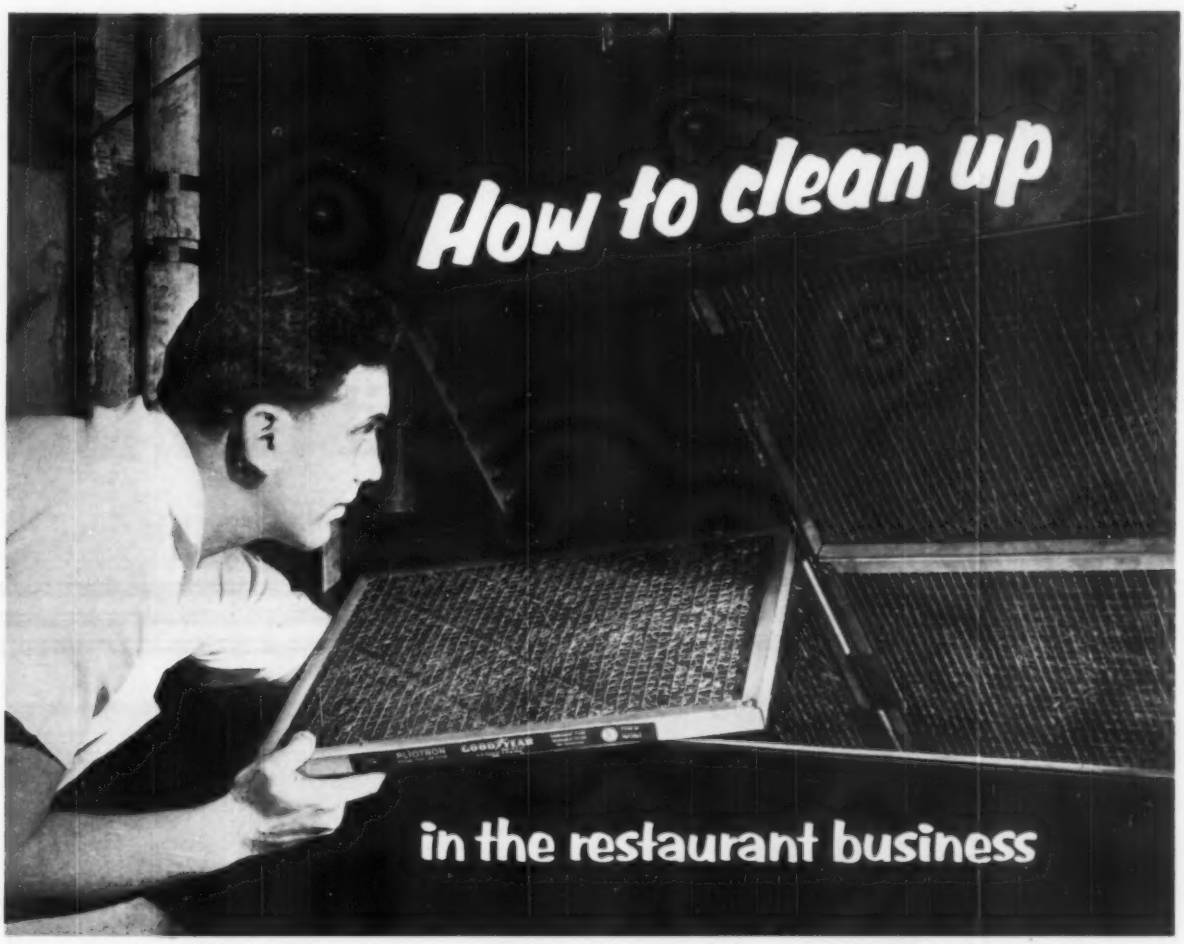
Possessing a solid reputation for dependable service, USS National Pipe is the choice of engineers and contractors throughout the country for air-conditioning, heating and power installations. It is synonymous with efficient, satisfactory service under all types of pressure and temperature conditions. For more complete information, get in touch with us. For technical assistance, our engineering staff is at your service.



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL PIPE

UNITED STATES STEEL



THIS heating and air-conditioning man found out—fast. It all started when he installed PLIOTRON super-filters in a metropolitan restaurant.

That one installation had spectacular results: For the PLIOTRON filters did far better than their predecessors. At the end of the year, filter costs had already been cut by 66% – with the filters still going strong.

That was only the beginning, too. For in a business where fresh, clean air is a "must," big news like this gets around. Soon this installer had a healthy PLIOTRON business among restaurants alone. Other industries soon caught on, as well.

There's no mystery about this trend to PLIOTRON. A depth-loader rather than an ordinary surface-loader—it captures up to 5 times as many of those fine, hardest-to-catch dirt particles as ordinary filters. It works longer between cleanings, then a quick rinse restores full efficiency. So it lasts indefinitely.

It's easy to see why more and more filter users are willing to pay a little more – initially—for PLIOTRON super-filters. And why more and more installers are using the PLIOTRON route to a growing business. For details write:

Goodyear, P. O. Box 288
Akron, Ohio

for cleaner air everywhere-

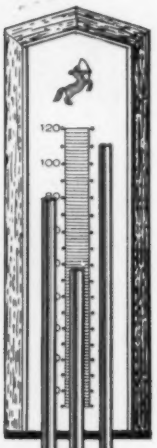
PLIOTRON AIR FILTER BY

GOODYEAR

60 YEARS

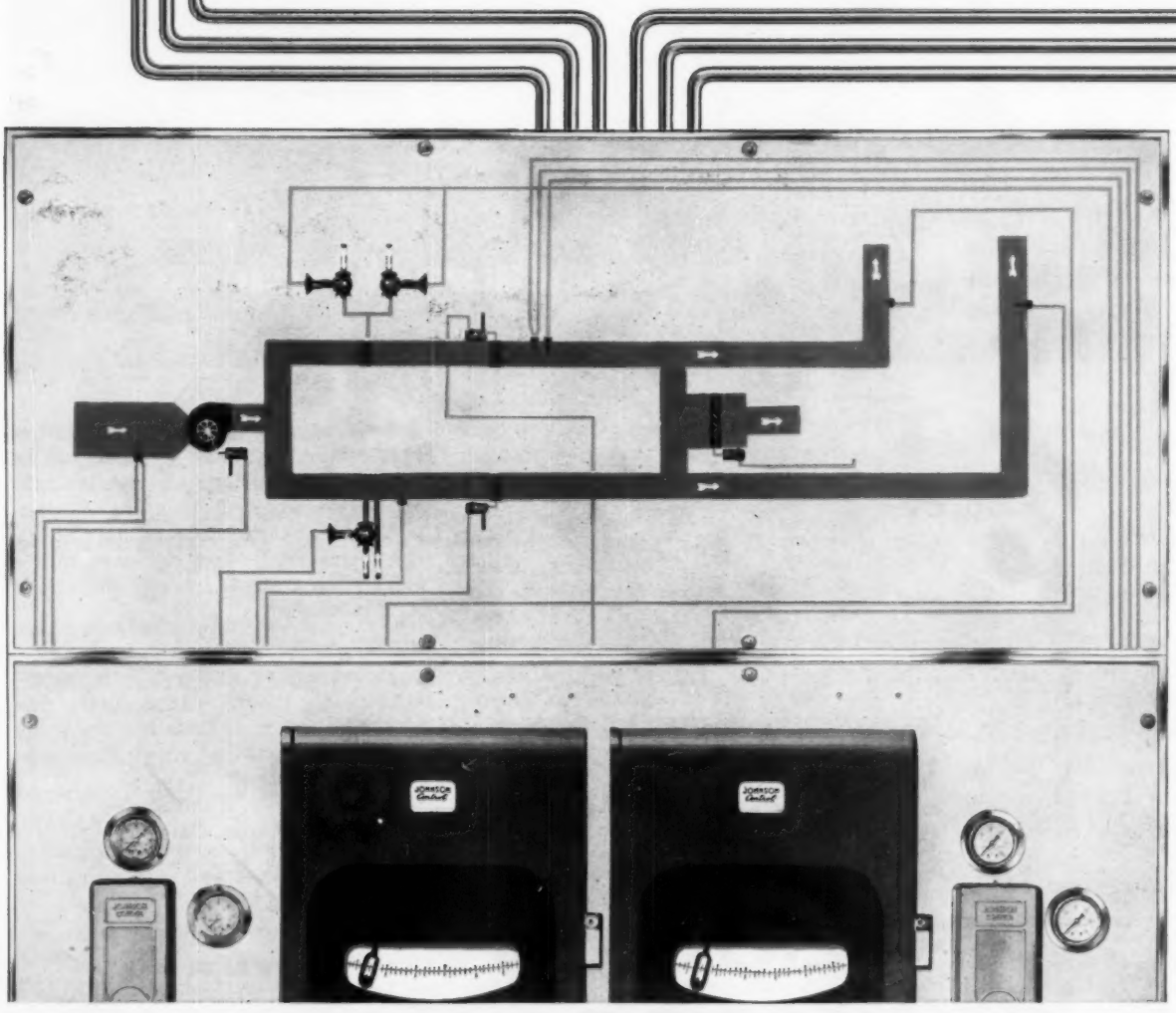
THE GREATEST NAME IN RUBBER

Pliotron—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio



PNEUMATIC AUTOMATIC

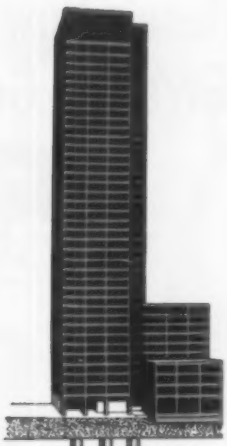
Keeps temperatures under with CHASE®



Typical pneumatic control panel has graphic illustration of Chase Copper Tube. Shows intricate pattern of tube controlling individual systems, of which there are thirty throughout the building from basement to penthouse.

CONTROL SYSTEM

control in Seagram Building copper tube!



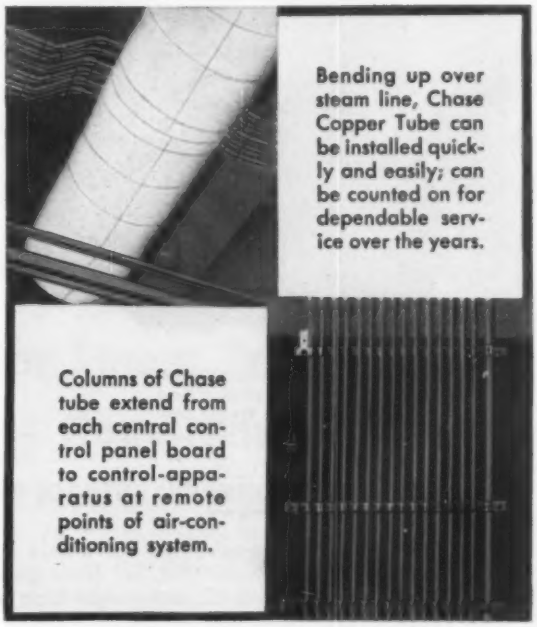
BRONZE SKYSCRAPER HAS 30 MILES OF CHASE COPPER TUBE

3,000 control valves...1,000 thermostats...dozens of panel boards...all inter-connected by a 30-mile network of Chase Copper Tube! That's what it takes to control the temperature, flow and pressure of air, steam and water for the complete air-conditioning system in the monumental new bronze building at 375 Park Avenue.

Only the best would do for New York's most modern, most magnificent skyscraper. So for the installation of its Automatic Temperature and Humidity Control System, a completely pneumatic control system, utilizing Chase Copper Tube, was used. Based on past performance, Chase Copper Tube was chosen for its durability, low cost and attractive appearance.

Quick and easy to install, Chase Copper Tube saves both time and money...makes a virtually "permanent" installation, operating always at peak efficiency. In addition, Chase offers prompt, completely reliable delivery of desired quantities—a vital factor where storage is at a premium and delay costly.

For time-tested quality plus the service you require, plan your modern control installation with Chase Copper Tube!



Bending up over steam line, Chase Copper Tube can be installed quickly and easily; can be counted on for dependable service over the years.

Columns of Chase tube extend from each central control panel board to control-apparatus at remote points of air-conditioning system.

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel

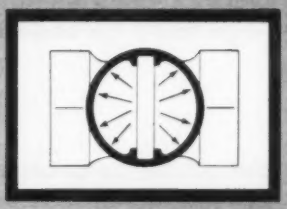
Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

Here's How KENNEDY'S Design and Construction Features Give You Greater Value for Your Valve Dollar...

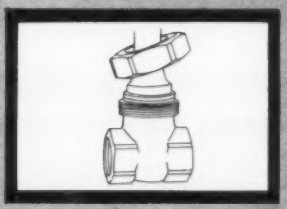
Fig. 525
125-Pound SWP Bronze Gate Valve
Union Bonnet - Rising Stem
Inside Screw - Wedge Disc

KENALLOY Stem . . . standard with Kennedy! Is strongly inhibited against dezincification and corrosion. It is a long-wearing metal for longer easier operation.

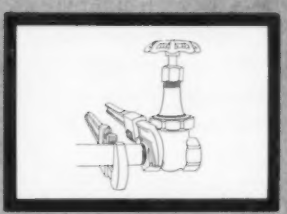
Cylindrical Body withstands sudden pressure. Kennedy's Cylindrical Body construction resists rupture and minimizes deflection when under severe pressure.



Heavy Bronze Union Bonnet Ring is entirely separate from the bonnet to eliminate any possibility of springing the bonnet face when assembling or disassembling the valve for cleaning or inspection.



The Kennedy wider hex ends are blended into body making the body and hexes one unit. This rugged construction prevents distortion and wrench pressure is absorbed.



These additional advantages make KENNEDY your best valve buy . .

Fig. 525 . . . newest in the valve field . . . best in the valve field. Fig. 525 gives greater strength with less bulk and weight than any comparably rated valve.

Kennedy's Fig. 525 can be repacked under pressure thus eliminating line shut-down. Simply open valve fully, remove packing nut and repack.

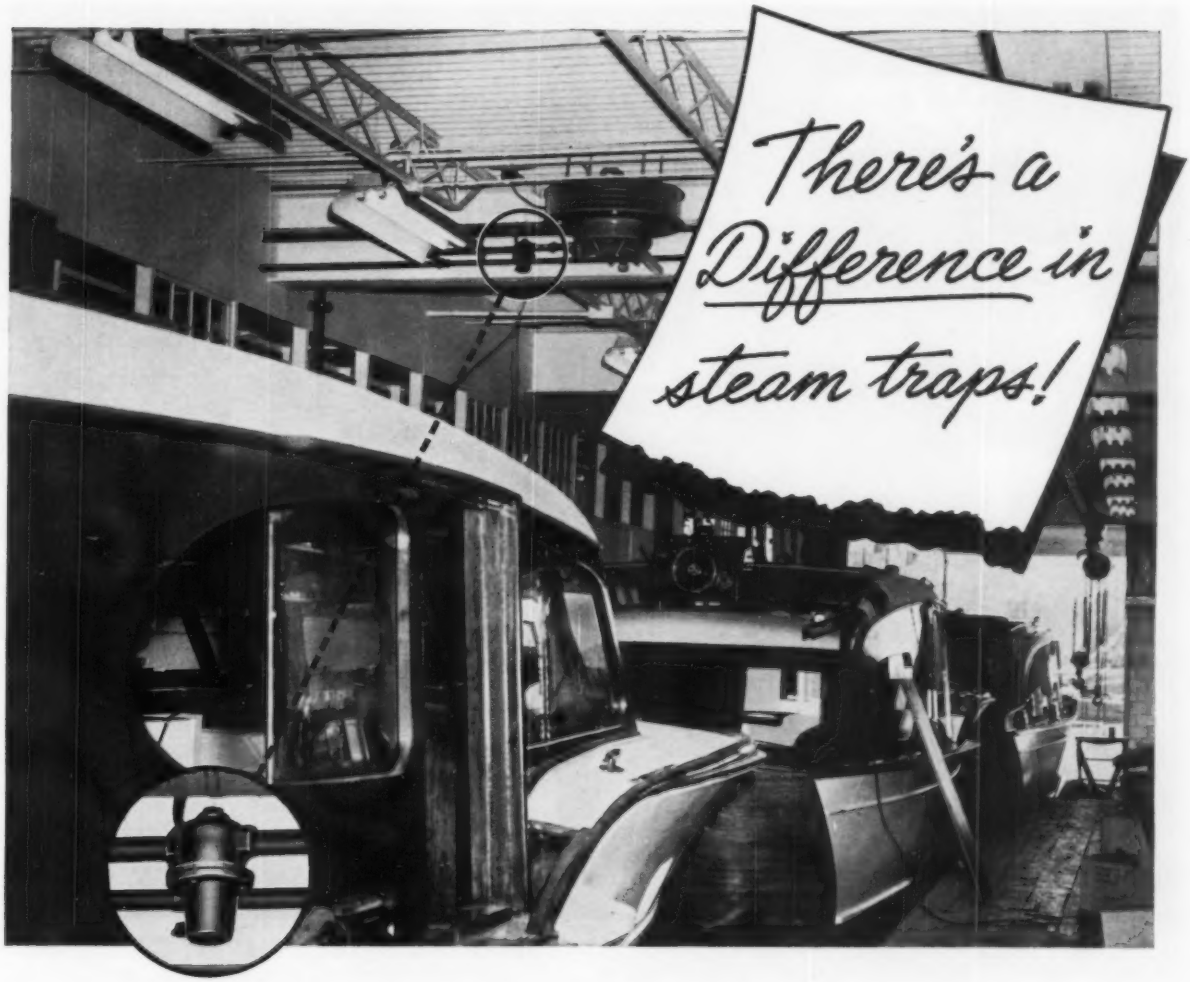
Threads in the KENALLOY Stem are accurately machined to eliminate feather edge ends which in ordinary valve stems break off and lock the stem in the bonnet. This accurate machining means easier operation and longer valve life.

The joint between the body and the bonnet is bronze-to-bronze true union. Generally accepted as the most satisfactory type of union joint.

• *YOU CAN'T BUY A BETTER VALVE THEN A KENNEDY!*

KENNEDY VALVE MFG. CO.
1607 EAST WATER ST., ELMIRA, NEW YORK
VALVES • PIPE FITTINGS • FIRE HYDRANTS

• OFFICES AND WAREHOUSES IN NEW YORK, CHICAGO, SEATTLE, SAN FRANCISCO, ATLANTA • SALES REPRESENTATIVES IN PRINCIPAL CITIES •



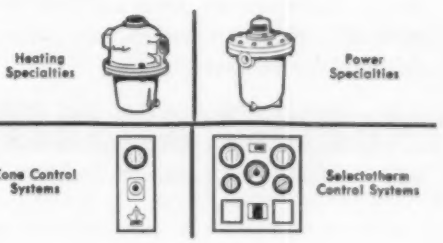
Do You Know of Any Other Steam Trap That Would Have Met This Requirement?

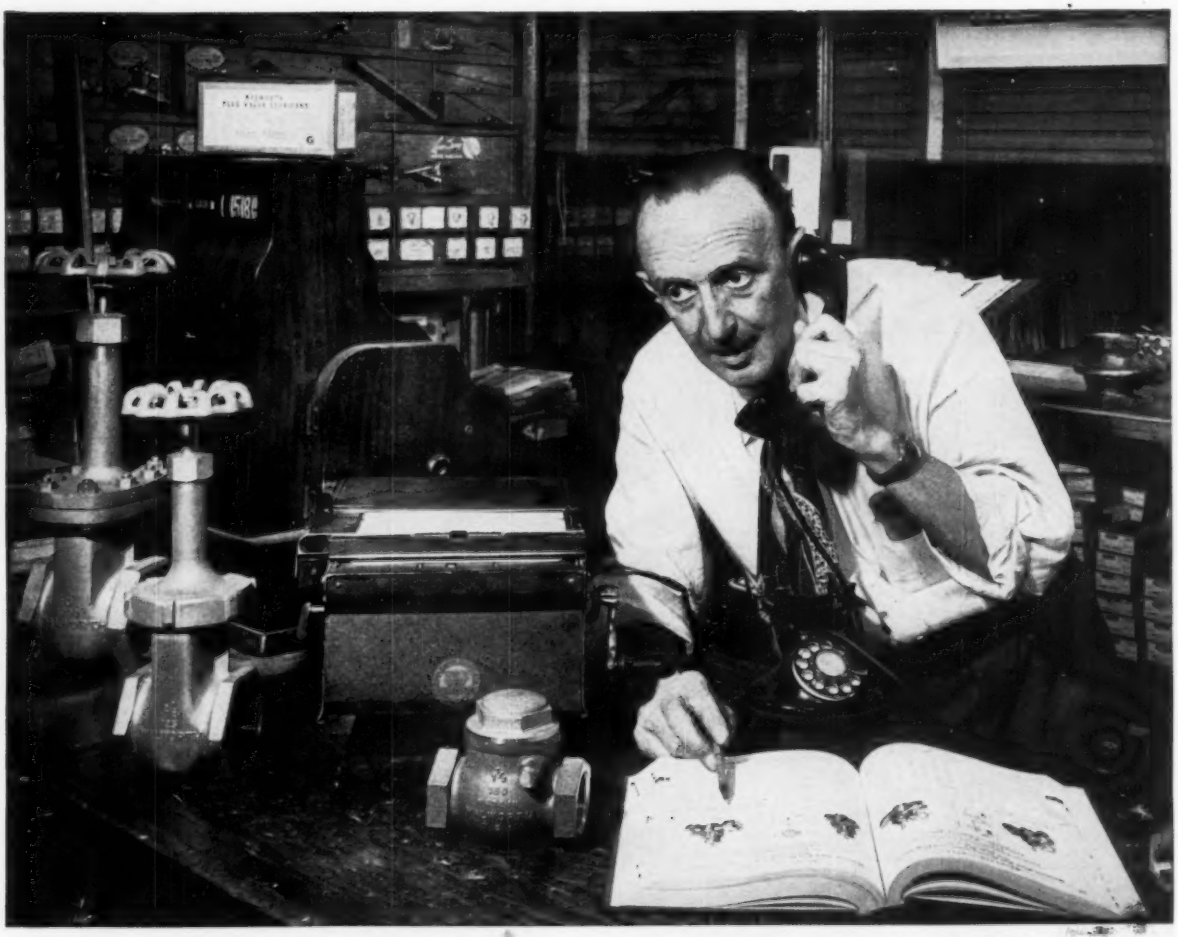
Here is one of nine production lines at Chris-Craft Corporation's Holland, Michigan plant. *Owners were insistent that no part of the building structure or its utilities should extend below the bottom flange of the ceiling beams.* That presented no problem for *Illinois* traps. Their unique design permitted in-line piping to Herman Nelson unit heaters (see inset) which left inches to spare! This guaranteed adequate headroom for boat masts and pulpits.

Also, Illinois traps had an outstanding durability record in prior Chris-Craft construction programs. Versatility and durability—two *good* reasons for specifying Illinois. Write for booklet, "There's a Difference in Steam Traps"—a case study at Sheaffer Pen plant.

illinois
ENGINEERING

Illinois Engineering Company
2035 S. Racine Ave., Chicago 8, Ill.
A Division of American Air Filter Company, Inc.





*Fictitious name used to typify over 400 Walworth Distributors

Here's why it pays to do business with distributors like Mr. Hansen*

Andy Hansen is typical of Walworth Distributors throughout the nation. He has been a distributor of Walworth Valves and Fittings for years. Like Andy, the Walworth Distributor in your area provides these services and savings:

He reduces your inventory costs. He's aware of the valve and fitting needs peculiar to his area. He stocks the products that will best serve your needs. Deliveries are always prompt and economical – emergency orders can generally be delivered within hours.

He offers you application and engineering assistance. His technical experience can be invaluable in solving your particular problems. He has 50,000 Walworth products at his disposal. You can be sure that the items he recommends are exactly right for the job.

He is a double guarantee. His business depends upon providing you with the very finest products and unsurpassed service. Every valve and fitting is backed by his own reputation and that of Walworth – a complete line manufacturer.

There's a Walworth Distributor near you ready to help. Call on him today.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

Walworth Company of Canada, Ltd., Toronto

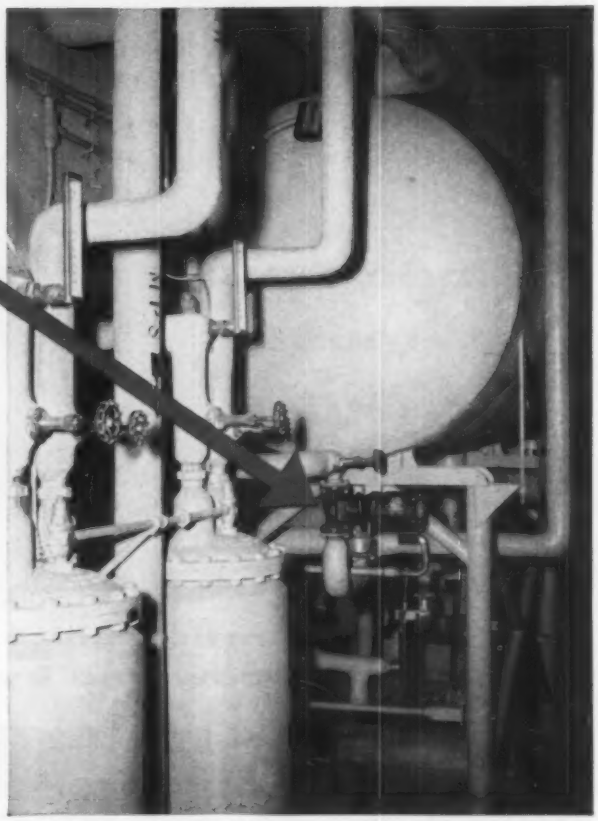
B&G ALL-BRONZE BOOSTERS

FOR LONG LIFE IN CIRCULATING HOT OR COLD RAW SERVICE WATER FOR FAUCET OR INDUSTRIAL USES

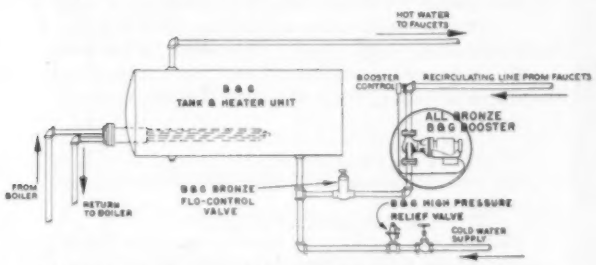
Where hot or cold service water is to be pumped, the use of an all-bronze pump is imperative. Otherwise, the corrosive effects of continuously pumping fresh water materially shortens pump life.

The B&G All-Bronze Booster is specifically built for service water pumping applications. In such systems, the Booster can be installed in numerous ways to step-up efficiency, increase hot water production and reduce heating costs. It is immune to corrosion, hence will give years of dependable service.

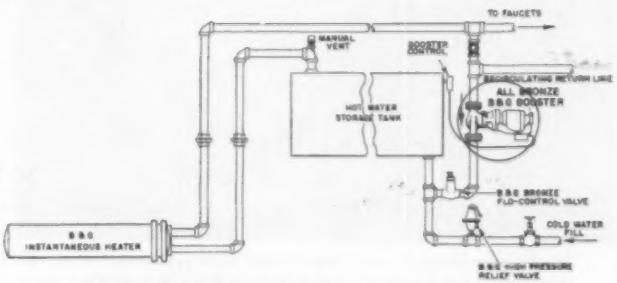
For *quiet* operation, failure-proof performance and long life, the B&G Booster is the *preferred* pump.



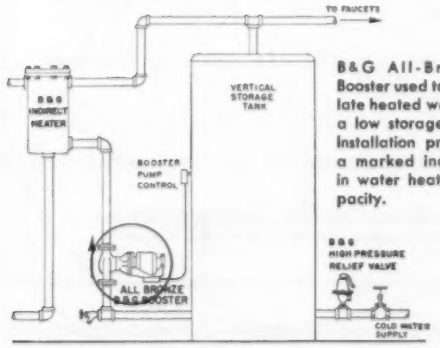
Installation of B&G All-Bronze Booster in Chrysler automatic transmission plant at Kokomo, Indiana. This small unit handles the circulating requirements of the service water heating system.



B&G All-Bronze Booster used on recirculating line from hot water faucets maintains hot water at fixtures at all times. Recommended on all installations, particularly where long plumbing lines are used.



All-Bronze B&G Booster used to provide an extra supply of hot water from an undersized boiler. Semi-tankless hook-up maintains initial supply of hot water.



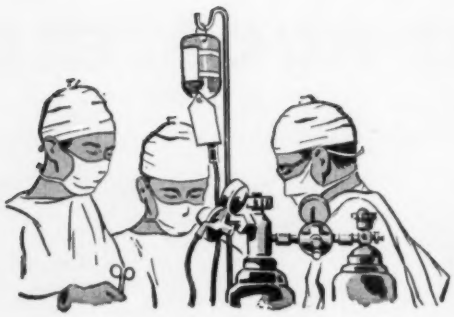
B&G All-Bronze Booster used to circulate heated water to a low storage tank. Installation provides a marked increase in water heater capacity.

Send for Bulletin No. IA-856

BELL & GOSSETT COMPANY

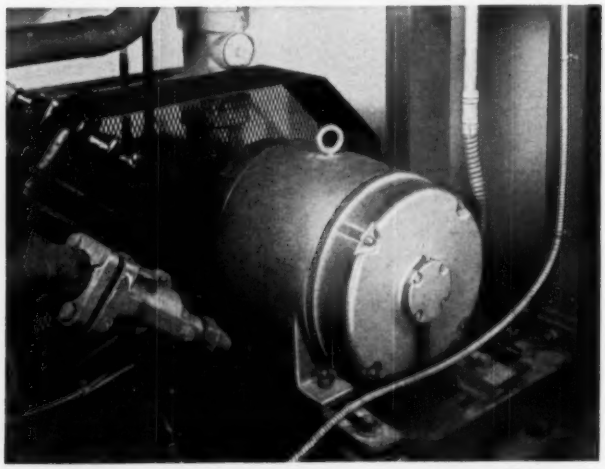
Dept. FD-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario



Blood Banks must NEVER FAIL...

Vital refrigeration units in St. Louis Blood Bank are powered by Wagner Motors



This 30 horsepower Wagner high torque, open type motor drives the refrigeration unit for the blood storage room in the St. Louis Blood Bank.

Wherever there is a motor application of a critical nature—even vital to life itself—Wagner Motors can be relied upon to fulfill their responsibility of completely dependable operation. In St. Louis' Blood Bank, for example, you'll find many Wagner Motors at work—driving the all important refrigeration units that keep the blood at proper storage temperature, that operate air conditioning compressors, that move heated and cooled air to keep the building comfortable in winter and summer.

Whether your motor application is vital to life or not, you can depend on Wagner Motors for efficient, reliable operation.

The complete line includes motors from ⅙ to 600 hp, singlephase or polyphase, in a wide variety of enclosure types and mountings. Let your nearby Wagner Sales Engineer help you select the right motors for your needs. Call the nearest of our 32 branch offices, or write direct.

Support your Local Blood Program by donating blood *regularly!*

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WM57-10

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Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

DESIGNED
FOR GRACIOUS LIVING

AND SERVED BY
125 THERMAL AIR CONDITIONERS

Houston's new, distinctive, 1400 Hermann Drive Apartment Building,* which overlooks beautiful Hermann Park and the famous Texas Medical Center, incorporates 125 Thermal Air Conditioners for year around comfort. Each apartment has its own unit which varies from 2½ to 7 tons in cooling capacity, as required by the living area.

Thermal Engineering manufactures a quality line of equipment that can be specified with confidence to deliver years of satisfaction. The Thermal line includes central plant air conditioners; multizone air conditioners; sprayed coil units; heating and ventilating units; cooling and heating coils and air-cooled condensers. Write for detailed information and specifications.

*Consulting Engineer:
Dale S. Cooper and Associates.
Air Conditioning Contractor:
Straus-Frank Company.

Agents in principal cities.

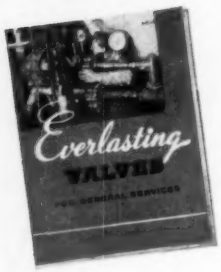
Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

2605 W. DALLAS • P. O. BOX 13254
HOUSTON 19, TEXAS

wide open . . . or shut tight — in a FLASH!

It takes less than a quarter turn to open an Everlasting Valve *wide* or close it *tight*. That's one of the many reasons why these time-proven valves are so popular wherever quick valve action is desired . . . on equipment outlets, storage and measuring tanks, process lines, boiler blow-offs, spray lines, meter testing, etc.



Write for Bulletin E160 describing their many other important advantages and with full information on types, sizes, etc.

For "everlasting" service, use

EVERLASTING Valves

EVERLASTING VALVE CO.
61 FISK STREET, JERSEY CITY 5, N. J.

EV389

THE NEW DISTRICT HEATING HAND BOOK

THIRD EDITION

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DISTRICT HEATING PLANTS
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ESTIMATING STEAM REQUIREMENTS
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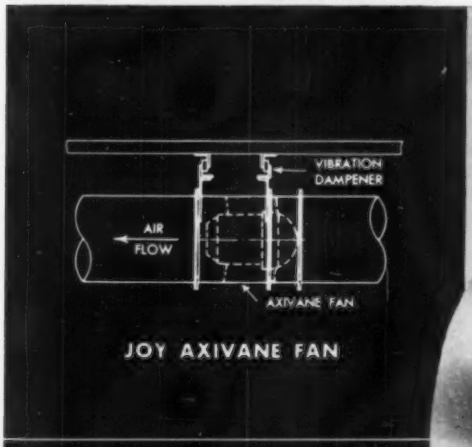
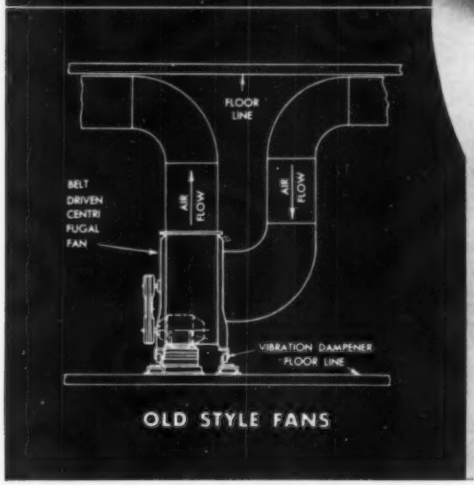
SALES ACTIVITIES
HOT WATER FOR DISTRICT HEATING

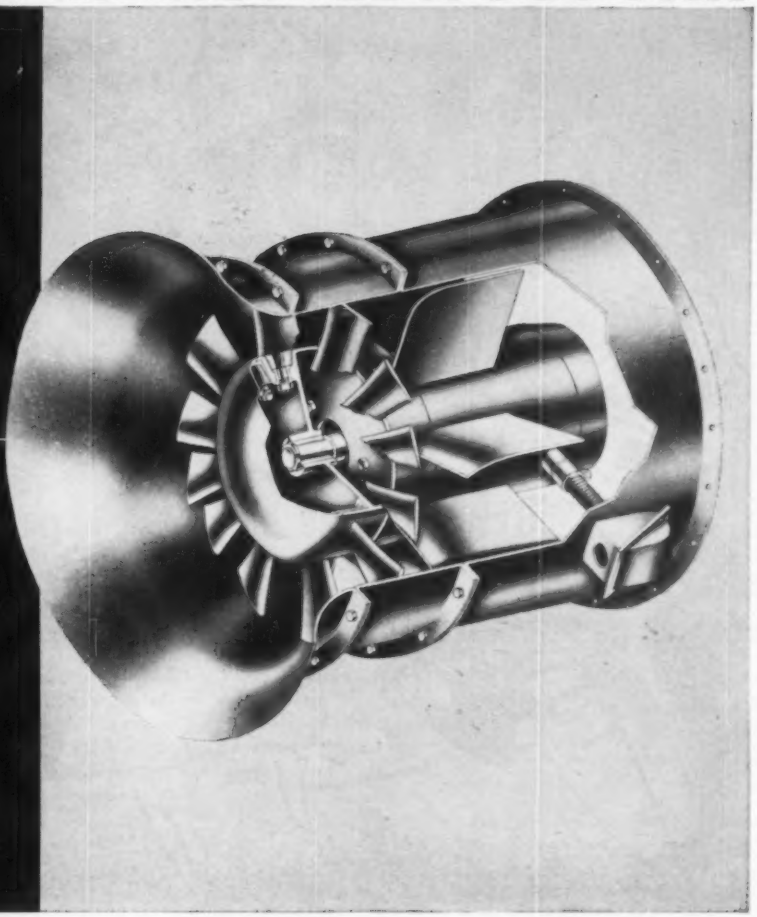
Price $7.00

NATIONAL DISTRICT HEATING ASSOCIATION
827 N. EUCLID AVE.,
PITTSBURGH 6, PA.

IT'S EASIER TO INSTALL A JOY FAN







JOY FANS SAVE SPACE

simplify engineering and installation

When you install a Joy fan you install a simpler system of ventilation. The Joy fan offers high performance in a compact package. The fan fits right into the duct . . . and the motor is inside the fan.

Saves cost because the installation can be made during the fabrication of the duct system. **Saves cost** because the installation can be made by relatively unskilled labor. **Saves cost** because the duct system is simpler . . . no offsets or elbows.

Saves cost because it turns valuable space over for rental or use (value averaging $5.00 per sq. ft. per month).

Study the drawings above. Notice the efficiency and compactness of the Joy fan compared to other systems . . . then call in a Joy engineer. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WSW-1 6820-198

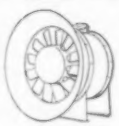
WRITE FOR FREE BULLETIN 199-41

JOY... EQUIPMENT FOR INDUSTRIAL PLANTS... FOR ALL INDUSTRY

Industrial Compressors

Conveyors

Electrical Connectors



Fans and Blowers

Some things are tough to get at...

That is Professor Tennis C. Williams in the picture. He has concluded, and rightly, that the nesting grounds of the Tyrolean Whooping Manscratcher (the only bird with a poisonous bite) are real tough to get at.

But compared with getting at certain working parts in certain evaporative condensers, the nest of the Manscratcher is as accessible as apple pie in a cafeteria.

That's why service men are sometimes tempted to use burglar tools, and maybe some nitro, when the job calls for getting at inner working parts that need normal servicing from time to time.

On the other hand Recold Dri-Fan Condensers—the best in every other respect too—are engineered for easy access. Just remove a few screws and go right on inside. With Recold's patented access door, spray nozzles and float valves are easy to get at, too.

When it comes to inspecting and cleaning drift eliminators—on some condensers the service man yells for a blow torch. To get at the drift eliminators on a Recold Dri-Fan Condenser you just remove the screws and pull them out like a drawer... yet joints are tight and leakproof without gaskets or sealing compounds. It's a matter of engineering and patented design.

Be sure the evaporative condensers you invest in have ACCESS. Be sure you ask for Recold's Dri-Fan!

RECOLD CORPORATION

7250 East Slauson Avenue, Los Angeles 22, California

This is an illusion

HOLD this Diagram by the right hand bottom corner and give it a slight but *rapid* circular twisting motion, at which time *each circle will separately revolve on its own axis*. The inner cogged wheel will be seen to revolve in an opposite direction.

THIS *is the real thing!*

insul-fil® the most highly efficient and economical "poured-type-insulation" available for underground steam and hot water distribution systems

The following comparative "K" factors were recorded at the Research and Development laboratories of the Atlantic Refining Company, and are evidence of INSUL-FIL's superiority.

The average "K" factor at 150 p.s.i.g. indicated the following values. These values were computed using 6" of material for the comparative evaluation. The average "K" factor on INSUL-FIL and 100% mined asphalt vary slightly depending on thickness of application.

"K" VALUES:

PERLITE	.39
INSUL-FIL	.451
100% MINED ASPHALT	.74
SOIL	3.12

Installing contractor Rhode Island Covering Co., U. S. Naval Air Station, Quonset Point, R. I., Charles A. Maguire and Associates, Consulting Engineers, Boston, Mass., Providence, R. I.

Installing INSUL-FIL at Idlewild International Airport for Port of New York Authority. (Seelye, Stevenson, Value & Knecht — Consulting Engineers)

COLLEGES and INDUSTRY use *insul-fil*. Can you afford not to?

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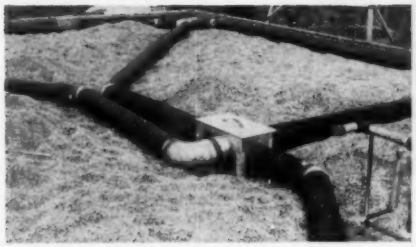
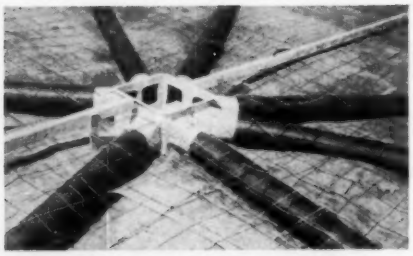
SONOCO

SONOAIRDUCT® FIBRE DUCT

for warm air gas and oil fired slab perimeter heating systems!





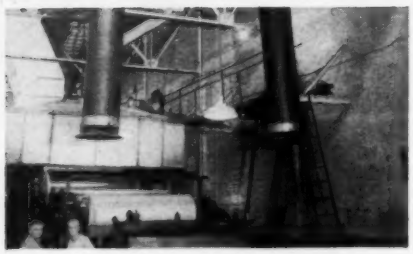
Sonoco SONOAIRDUCT Fibre Duct is a lightweight duct made especially for supply or return lines. It should be encased with a minimum of 2" of dense aggregate concrete. The minimum thickness of concrete over the loop duct should be 2½", and continuous mesh reinforcing not less than 6 x 6—10 gauge and 18" wide should be placed in the concrete and centered over the duct. Installation should be made in accordance with Sonoco Manual No. 557. When properly installed, Sonoco SONOAIRDUCT Fibre Duct will materially reduce costs without lowering the quality of construction. This fibre duct is more economical than metal, glazed tile, clay pipe, or concrete duct.

Sonoco SONOAIRDUCT Fibre Duct is aluminum foil lined for lower coefficient of air friction. The air friction loss of 8" Sonoairduct is 0.151" of water per 100 feet at a velocity of 800 feet per minute and 70° F. The black duplex kraft outer wrap retards excessive moisture penetration through the duct wall. The action of the adhesive, used in the manufacture, when subjected to normal heating temperatures, causes the duct to cure and improve with age. This action results in a product that is practically waterproof, thus preventing delamination. This fibre duct will withstand temperatures as high as 275° F indefinitely.

Sonoco SONOAIRDUCT Fibre Duct minimizes transmission of sound from furnace and from room to room. It has a heat conductivity of 0.46 BTU per hour per square foot per degree F per inch of thickness. This insulation value prevents hot spots in the slab above the encased duct, resulting in more heat to the diffusers or registers where it is desired.

Available in 23 sizes, 2" to 36" I.D., up to 50' long. Can be sawed to exact lengths on the job.

Large diameters are ideal for commercial and industrial heating-ventilating



Sonoco SONOAIRDUCT Fibre Duct is available in diameters up to 36" I.D. The larger sizes have been used in a wide variety of commercial and industrial heating and ventilating installations. The low initial cost and handling ease, due to lightweight, long lengths, saves money and installation time.

For complete information and prices, write

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Construction Products

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. . . sets the pace in pump performance

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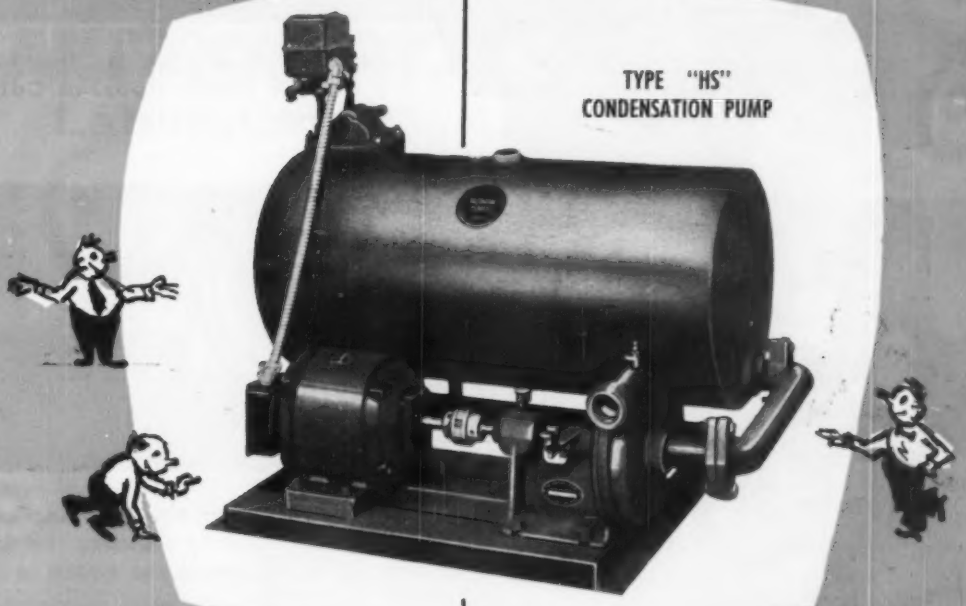
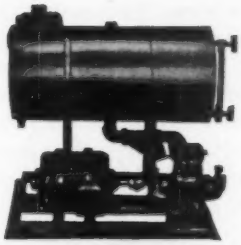
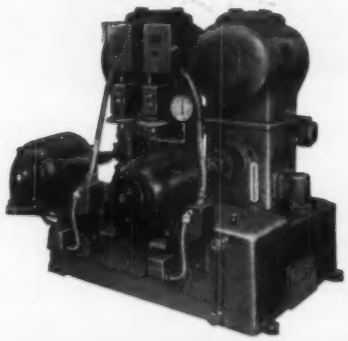
CONDENSATION PUMP





"TM" TURBINE

"UV" TYPE



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Yes, the popular "HS" Condensate Pump possesses all the fine features that are found in every Skidmore Pump: Expert engineering, ruggedness, dependability, plus, economy and efficiency.

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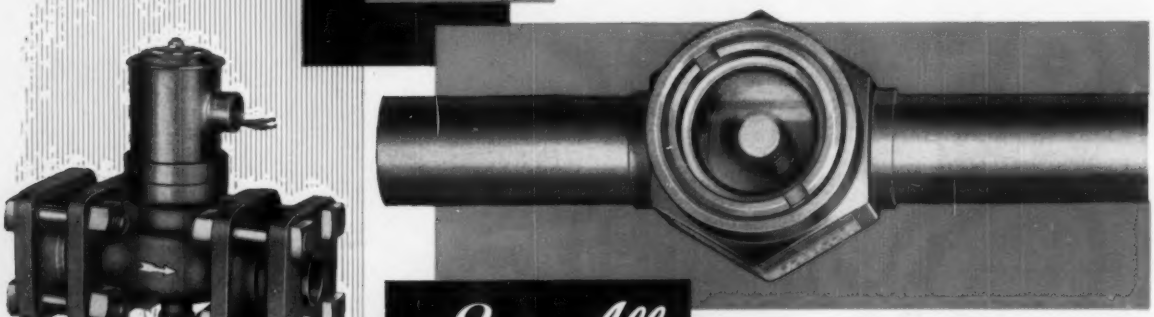
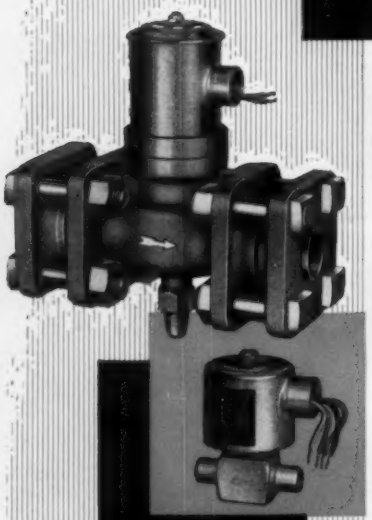
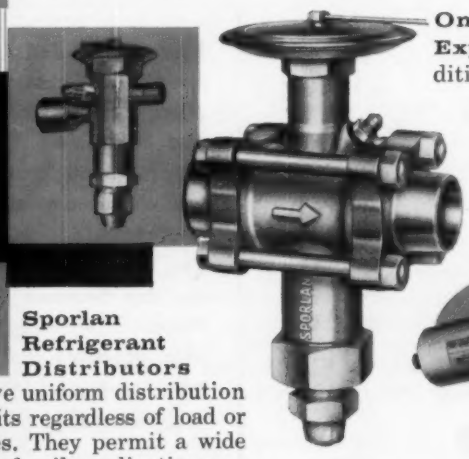


THE See-All

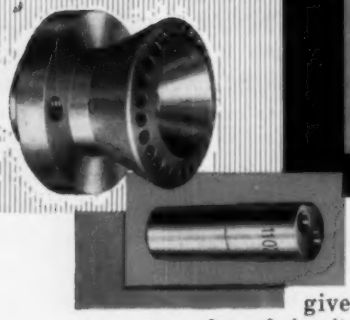
The amazing new **Sporlan See-All** shows you at a glance the degree of dryness and the amount of refrigerant the system is carrying.



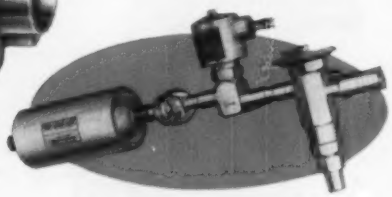
Sporlan Solenoid Valves with the Power Packed Blue Seal Coil defy burn-outs.



Only Sporlan Thermostatic Expansion Valves for air conditioning offer the Flow Master element, which minimizes valve hunting... smooths out evaporator performance regardless of size.



Sporlan Refrigerant Distributors give uniform distribution for any number of circuits regardless of load or evaporator temperatures. They permit a wide range of coil applications... thanks to the Sporlan interchangeable nozzle!



Buy Sporlan Right Down the Line from your wholesaler for your next air conditioning installation, and no matter what the size of the job, Peak Performance Right Down the Line will be yours!

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All

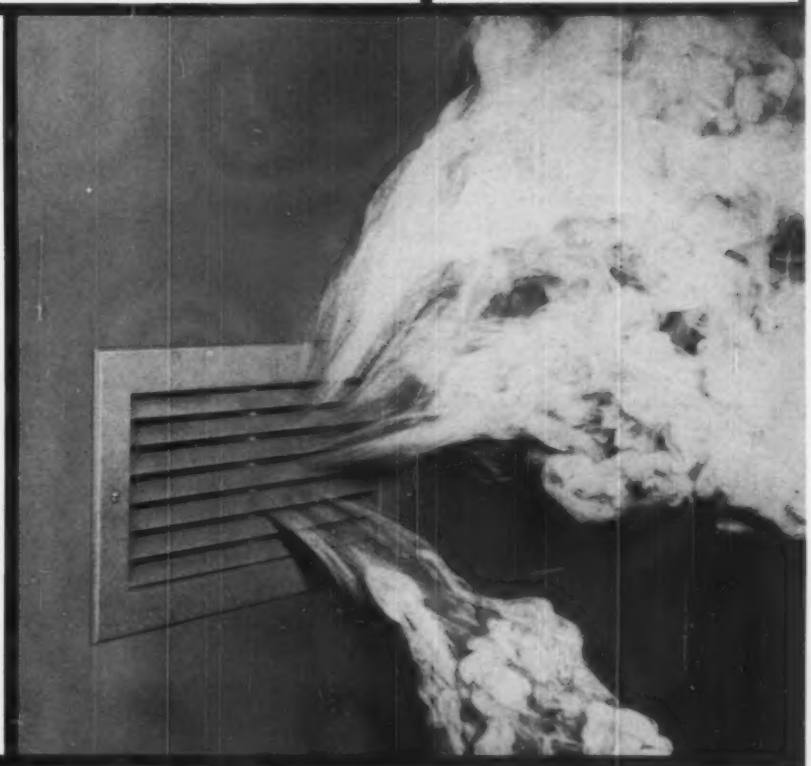
WATERLOO

Registers and Grilles are tested and approved by

ANEMOSTAT® Laboratories

TESTED · APPROVED · ANEMOSTAT CORPORATION OF AMERICA

This smoke test picture, illustrating the exhausting of room air through Waterloo style 3H Return Air Grille, was taken in the Anemostat Laboratories in Hartford, Connecticut. It is one of a series of tests conducted by Anemostat research engineers to insure maximum efficiency of Waterloo equipment. In installations throughout the country, Waterloo registers and grilles are used with Anemostat air diffusers — a combination that results in top-quality performance.



Waterloo supply registers and grilles feature the exclusive silent flow "tear drop" louvre design. They are manufactured in a modern plant using the most efficient techniques, and every Waterloo unit is backed by 56 years of experience in air conditioning, heating and ventilating applications. ● These, plus Waterloo's wide range line and fast service on specials, are good reasons why it pays to install Waterloo units in your next job.

Write for Waterloo Catalog, containing complete data.

WATERLOO

REGISTER CO., INC.

WATERLOO, IOWA

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REGISTERS • GRILLES • VOLUME CONTROL DAMPERS • DOOR VENTILATORS

O-B VALVES

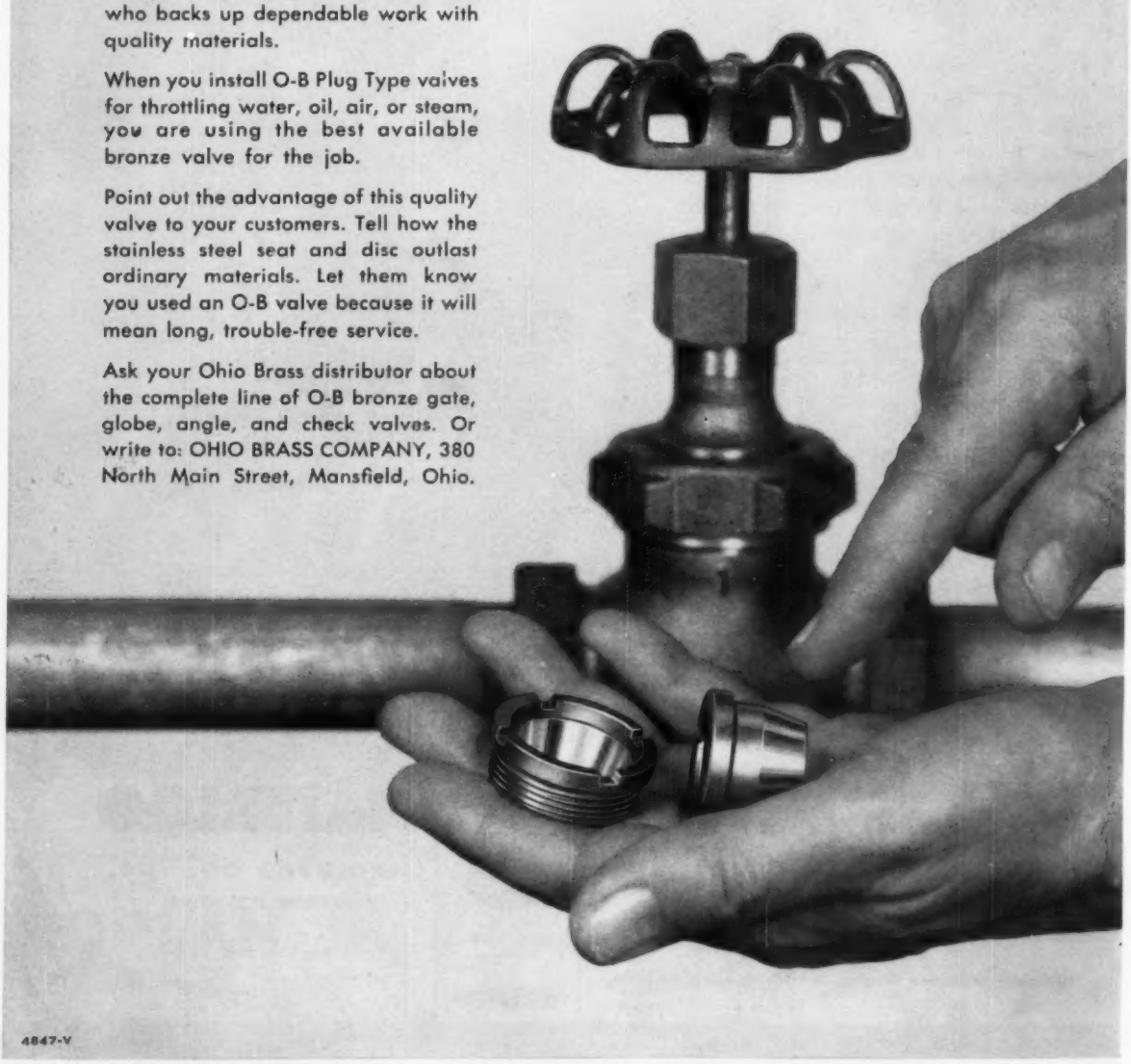
how to stay ahead of competition

The contractor who will stay ahead of today's tough competition is the one who backs up dependable work with quality materials.

When you install O-B Plug Type valves for throttling water, oil, air, or steam, you are using the best available bronze valve for the job.

Point out the advantage of this quality valve to your customers. Tell how the stainless steel seat and disc outlast ordinary materials. Let them know you used an O-B valve because it will mean long, trouble-free service.

Ask your Ohio Brass distributor about the complete line of O-B bronze gate, globe, angle, and check valves. Or write to: OHIO BRASS COMPANY, 380 North Main Street, Mansfield, Ohio.



4847-V

Another new development by Iron Fireman

MicroMist
TRADE MARK

HEAVY OIL
BURNER

TWO-STAGE ATOMIZER CHANGES HEAVY OIL TO AN AERATED FOG, WITH THE CHARACTERISTICS OF A GAS—NOT A SPRAY

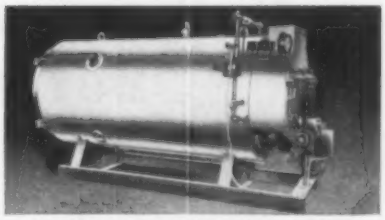
Now a medium size burner that fires low cost oils

New two-stage atomizing principle

The heart of the Iron Fireman MicroMist burner is an ingenious compressor-atomizer. The compressor reduces the oil to an air mixed spray (which is as far as other burners go) then by the heat of compression, into an air-oil vapor. The oil is so finely divided that it becomes an oil mist or fog that will remain in suspension for several hours. It is easily and directly ignited by an electric spark (does not require gas ignition). Now medium size heating plants (previously restricted to light, expensive oils) can switch to low cost heavy oil with substantial savings in fuel costs.

Note these additional features

The Iron Fireman MicroMist burner is as easily installed as a conventional gun type burner. It has two important uses. (1) As a conversion burner with any type of boiler. No special boiler front is required. (2) As a component part of a packaged boiler-burner unit. The choice of oil grades is almost unlimited (from No. 5 down to the lightest fuel oils). Integral control panel is wired and tested at the factory. Fuel and maintenance costs are low. Eliminates frequent nozzle inspection and cleaning, because of the large orifice to disperse the oil mist. Fires low-cost, heavy oils with little more attention than a domestic oil burner.



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Installation requires little more than service connections. Easily specified from catalog list of sizes and capacities. Available for either natural or forced draft. Firing unit can be ordered separately for installation in any type of boiler.

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FOR HEATING, POWER, PROCESSING

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Bethcon is the galvanized sheet product of Bethlehem's continuous process. As the steel coil moves through the line, it receives a continuous annealing treatment which gives the sheet a desirable combination of strength and ductility that ordinary galvanized sheets just don't have. This means easy workability for sheet-metal men, yet a strong end-product for the customer.

Continuous galvanizing also applies the zinc coating to the steel so tightly that even the toughest forming operations will not crack or otherwise damage the coating. The coating is uniformly distributed over the sheet, and there is no heavy bead on the drip end, as there is with conventionally galvanized sheets.

You can order Bethcon sheets in cut lengths or coils, 13-gage and lighter, with either plain open-hearth or copper-bearing (Beth-Cu-Loy) steel for the base metal, depending on your requirements. If you would like further information or advice about Bethcon, just call or drop a line to the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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BETHLEHEM STEEL

BETHLEHEM STEEL

1957 Construction Hit Record $47.2 Billion

. . . 3 percent over 1956

OUTLAYS for new construction for the year 1957 totaled $47.2 billion—about 3 percent above the record $46.1 billion spent in 1956, according to estimates prepared jointly by the U.S. Depts. of Commerce and Labor. Expenditures were at peak levels in 1957 for a large majority of the major types of private and public construction, but there was a narrowing of year-to-year gains for some important components.

Primarily because of the decline in private dwelling unit construction, last year's overall rate of increase in total construction activity was the smallest in the 12 years since the end of World War II.

The physical volume of total new construction in 1957 (expenditures adjusted for price changes) was about the same as in 1956. However, when private residential building is excluded, the constant dollar value (in 1947-49 prices) was up 3 percent.

The record $33.3 billion spent for private construction in 1957 was only slightly above the 1956 figure, whereas public outlays rose 9 percent to a new high of $13.9 billion.

New private housing activity, still influenced by a shortage of mortgage funds, declined by 10 percent in 1957 to $12.2 billion, about the same relative decrease as occurred in 1956. By mid-1957, however, the two year slide in private residential construction appeared to be checked, and outlays (seasonally adjusted) rose steadily through the end of the year, largely on account of the rise in apartment building.

The $1.3 billion drop from 1956 to 1957 in new private housing outlays was offset by gains in all other types of private work except store and school building. Expansion by public utility companies accounted for the largest dollar increase in the private sector during 1957. Total utilities expenditures rose by $717 million to a record $5.8 billion.

The sharpest percentage gain in private work was shown by hospital and institutional building, which rose 54 percent over the year to a record high of more than a half billion dollars. Other types of private construction which achieved an unprecedented dollar volume last year were religious building and social and recreational facilities. Private school building declined a little from the record set in 1956.

The three year expansion in private industrial plant leveled off in 1957 as production capacity in many cases caught up with demand. Outlays for new structures totaled a record $3.2 billion in 1957, but the year-to-year gain was only 3 percent, compared with 29 percent in 1956 and 18 percent in 1955.

Store building reversed a four year expansion by declining 12 percent in 1957, and, though office building expanded for the fifth successive year to a new peak, the rate of increase was less than half that shown in 1956. This category was at peak levels, however, in recent months.

Schools were a major factor in last year's $1.1 billion increase in the public total. Public school building scored an 11 percent rise to $2.8 billion—a rate of increase that was 2½ times the gain shown between 1955 and 1956.

Almost all other public construction categories also showed increases from 1956. Outlays for public hospital and institutional buildings showed an upturn for the first time in six years, and spending for administrative and service buildings was boosted by expansion in Federal, state, and local projects. Public service enterprises edged up to a new record because of gains in airfield construction.

Federal spending for industrial plants (mostly atomic energy facilities) was virtually unchanged from 1956 to 1957, and amounted to about a fourth of the amount spent in 1953—the postwar peak year for this category. ⧺

Garden of Eden Climate Cited as Man's Ideal

. . . at climate design conference

THE Garden of Eden's ideal climate maintained body comfort for Adam and Eve at an air temperature of probably 85 F, Dr. L. P. Herrington, Yale University lecturer and research director of the Pierce Laboratory of Hygiene, told the first U.S. conference on indoor climate design at the University of California at Los Angeles recently.

He based the estimate on the normal skin and deep temperature of the human body that is not insulated by clothing. Clothing, said Dr. Herrington, has an insulating value of 15 to 16 F.

The conference, jointly sponsored by the UCLA School of Engineering and the Institute of Heating and Air Conditioning Industries, sought to solve the problem of how man can safeguard his health and well being through control of his indoor climate.

Dr. Herrington, nationally-known authority on physiological engineering, called on the nation's builders to assume leadership in climate design as the "great physicians and physiological engineers of mankind."

Evidence is mounting, he related to an audience of builders, architects, engineers and contractors, that thermal conditions may have greater effect on shortening human life than hard work, and that only insulation may protect man from the cumulative effect of atomic radiation and other air contamination.

"While no alarm may be felt on this topic immediately," said Dr. Herrington, "we are in a period where industrial processes are certain to vastly increase the radiation exposure to which man is normally exposed.

"In the event of war, a large proportion of the population surviving attack in urban areas will carry an accumulated radiation effect which will restrict their lifetime. In such a regrettable situation, construction techniques may well become of critical interest to millions of people overnight."

Experiments with animals indicate that different climates can produce structural and organic changes in human beings as the result of the stress of heat and cold. Military tests also indicate that unfavorable climates, uncompensated by conditioned housing, reduce human life expectancy.

"Ambient temperature alone," said Dr. Herrington, "has been found to have a large effect on the precision of skilled muscular acts as well as the execution of practiced logic.

"Accident rate among miners bears an orderly relation to temperature. Near 60 F, accidents were at a minimum, with increase of two to threefold at temperatures of approximately 80 F.

"Studies in British munitions factories show that both cold and heat stress increase the frequency of accidents in manual operations. Accidents were at minimum at 67 F, but increased above and below this temperature.

"In long periods of code reception, errors increased from an average of 12 per hr to more than 90 as the temperature was increased from 70 to 97 F."

Comfort factors other than average temperature must be considered by the designer and the builder, Dr. Herrington stressed. Among these are satisfactory methods of heating and cooling for special populations and work activities. ⧺

Air Conditioning Industry To Hold 1957 Sales Level

. . . maybe increase moderately

INDUSTRYWIDE sales of air conditioning equipment for 1958 will probably continue at the 1957 rate, with the possibility of a moderate increase, according to D. C. Minard, Trane Co. president.

Mr. Minard says key factors in the outlook for 1958 include:

1) The rate at which new buildings will be constructed. Many of these buildings will be air conditioned. Current reports indicate that the construction industry in 1958 will equal or slightly improve 1957 levels.

2) The extent to which existing buildings will be air conditioned. There are indications that modernization programs will continue and possibly show a slight gain in existing buildings in 1958 — and hand-in-hand with modernization goes air conditioning.

3) The degree to which the weather will influence certain segments of the industry. In the past, the weather has been a strong influencing factor in the sales of package air conditioning equipment. On the other hand, sales of air conditioning equipment for use in big buildings or industrial plants are less influenced by weather changes, resulting in a more stable market.

Taking into account the effects of these three points, Mr. Minard says: "Industrywide air conditioning sales are likely to hold current levels with the possibility of a moderate increase.

"We expect to see more air conditioning equipment go into existing multistory office buildings this year. As in the past, the competitive factor remains—and owners of large buildings are air conditioning in order to attract and hold first class tenants."

Moving to the industrial scene, he pointed out that there would likely be increasing activity in factory cooling for employee comfort and that a greater percentage of new factories would be air conditioned in 1958.

Industrywide shipments of self-contained air conditioners for use in the small commercial field "should in 1958 be of about the same size as 1957," continued Mr. Minard.

Schools, religious buildings, apartments, and hospitals are expected to represent an increased market in 1958. Estimates range from a 3 to 5 percent increase in construction activity in these fields. ⧺

"Quote"

"Air conditioning at its best is far more than just cooling or heating. It is temperature and humidity control. It is the cleaning and circulation of air. It is ventilation. Air conditioning is all of these simultaneously."—*Cloud Wampler, chairman of the board, Carrier Corp., at the Government-Industry Symposium on Air Conditioning, Washington, D.C., last year.*

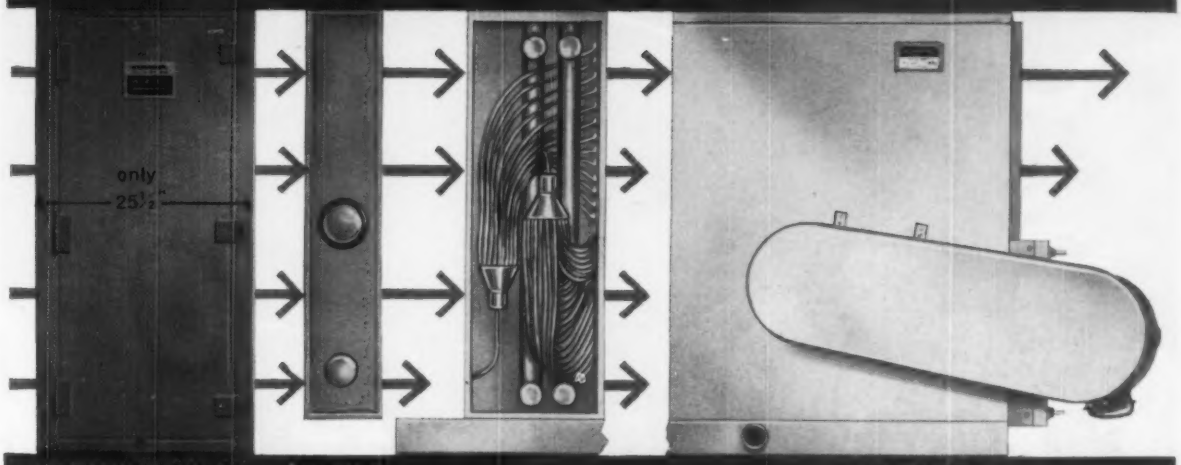
Proclaim Feb. 16-23 Brotherhood Week

. . . urge everyone's support

NATIONAL observance of brotherhood Week, sponsored by the National Conference of Christians and Jews, will be held Feb. 16-23. President Eisenhower is honorary chairman.

The 1958 theme is Brotherhood for Peace and Freedom — Believe It! — Live It! — Support It! — that people shall live as one family of man. ⧺

NOW YOU CAN HAVE "IN LINE" ELECTRONIC AIR CLEANING WHEREVER AIR DISTRIBUTING UNITS ARE USED



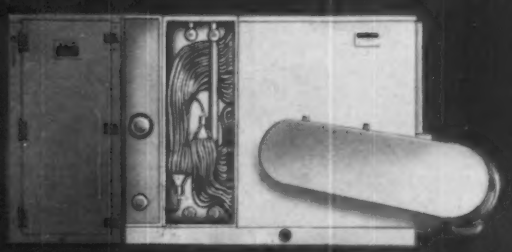
Westinghouse Electronic Air Cleaner Sections for "In-Line" Assembly . . . 25½" in direction of air flow . . . no additional access space required!

PRECIPITRON®, the original Electronic Air Cleaner, provides top-notch cleaning efficiency in Westinghouse Air Distributing Units!

Here's proof: U. S. Bureau of Standards Blackness Test . . . Ordinary mechanical filters — 5-15% efficiency

Westinghouse PRECIPITRON — 85-97% efficiency

Don't just *FILTER* your air when you can *CLEAN* it . . . inexpensively!



Precipitron Air Cleaning Section Combined With Air Distributing Units for Application at Normal Cooling Coil Face Velocities . . . Up to 28,000 CFM, Up to 150 Tons.

Westinghouse manufactured fans, motors, heating and cooling coils and Electronic Air Cleaning sections are matched together to meet your requirements for heating, ventilating, air conditioning and air cleaning . . . all with a single equipment warranty . . . a Westinghouse exclusive!

Case studies prove that in commercial installations Westinghouse PRECIPITRON pays for itself in less than one year through savings in cleaning and maintenance costs.

One Unit, One Supplier, One Price! Westinghouse now offers you the complete air handling package — Electronic Air Cleaner, heating coil, cooling coil and fan section — ready for your electrical, piping and duct connections.

More Information?

Call your nearest Sturtevant Division Sales Engineer, or write Westinghouse Electric Corporation, Dept. B-2, Hyde Park, Boston 36, Massachusetts.

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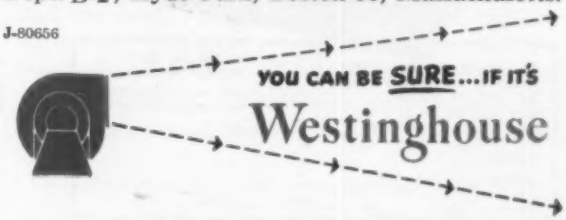

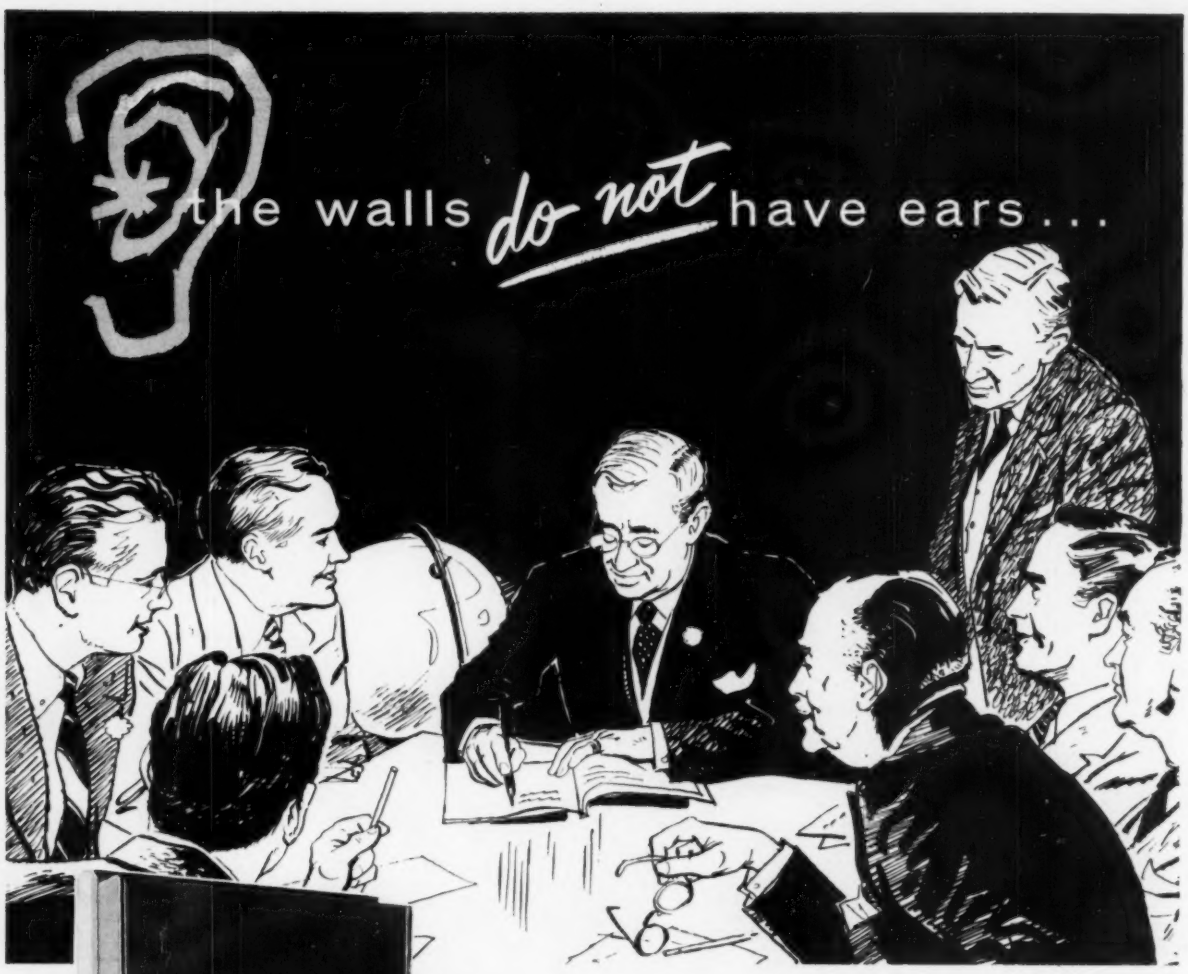

with Quiet VENT silencers

on return air vents

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Literature describing this unique noise control unit that permits the free passage of air, while filtering out sound, is available upon request.

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"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Engineer's Responsibility: Protect Building Owner, Contractor Equally

I FEEL THAT E. W. Klein, Jr.'s "Open for Discussion" comments *Suggests Two Sets of Standards Be Adopted for Spec Writing*, in the September 1957 issue, should be given headline attention.

I think there is too much compromise being experienced all through the construction field. Too little concern is given for the owner who will have to occupy the building.

It is my impression that the responsibility of the engineer and architect should be extended equally to the owner, seeing that he gets the best possible installation for his available money, and to the contractor, to protect him from the owner demanding more than the contract calls for. It will be interesting to see if and what the opinion of others is in this regard.

LEROY E. PETERSEN
A. A. Maycock Co.
Salt Lake City, Utah

Feels Electricity Too Expensive To Compete With Other Fuels

I HAVE READ with interest the comments which have appeared on these pages on electric heating of an Indiana schoolhouse.

We have just had an opportunity to bid on a school heating job in direct competition with electric heating. We find that our direct fired heating system was 30 percent less expensive to buy. From our calculations, it would appear that the electric heat, at best, would cost about 260 percent more for operation cost than the oil fired plant.

The electric utilities maintain that the use of electricity requires one less custodian and that his salary could be credited to the higher electric fuel expense. However, it is not the practice in this state to have a school custodian to watch an oil or gas fired heating plant. Gas and oil firing is considered as automatic as electric heating in most Indiana schools. There is no difference in the number of maintenance personnel for any of these three types, and, therefore, no salary saving from using electricity.

The electric people have also advanced the idea that if more insulation were used in the buildings the operating cost of the electric plant would be held down. Wouldn't the fuel cost of an oil or gas fired conventional plant also be proportionately lower with extra insulation?

It would appear that the electric fuel people had best save their energy for some 30 to 40 years from now, when gas and oil fuels will probably be twice as expensive, and electricity will be perhaps only 75 percent of today's price.

J. H. ELLIOTT
Elliott-Williams Co.
Indianapolis, Ind.

Forced Draft Firing Prone To Wide Misunderstanding

I FEEL that Kalman Steiner's reaction (on these pages, November 1957) to my article, *Pressurized Firing: When, Where, How Do We Use It?*, in the October 1957 issue, demonstrates the wide misunderstanding which can develop on this subject.

All of the points that Mr. Steiner brings out in regard to forced draft firing are, of course, correct. It again comes down to a matter of definition as to exactly what forced draft firing is.

Whether or not there is to be an induced draft fan in conjunction with forced draft firing depends upon the ability of the existing or proposed installation to provide sufficient natural or induced draft to maintain a zero furnace pressure condition. If, for instance, a typical boiler to be fired has a pressure drop of 0.1 in. water gage across itself and possibly another 0.05 in. WG drop in the breeching, and if a natural or induced draft of only 0.1 in. WG were available, it would follow that the combustion chamber or overfire pressure condition in the boiler would be 0.05 in. WG positive. Since the firing doors and the cleanout or breeching doors, etc., normally would not be set up to receive a positive pressure, there would be a leakage of flue gases or combustion products into the room. Therefore, an undesirable condition would exist.

Now, assume these same circumstances and also that the boiler equipment is tightly sealed and designed in a manner to permit positive pressures. The result would not be a forced draft firing unit, but would, in fact, be a pressurized firing unit which, in the example noted above, would be of a very low order.

In reponse to the final paragraph of Mr. Steiner's

comments, we certainly concur that under any condition or type of firing the combustion chamber or boiler firebox should be tightly sealed. It has been our experience that a loose setting in the boiler substantially reduces the draft available and infiltrates the products of combustion, thereby reducing overall efficiency. While it is true that a tight firebox will prevent oil seepage, I do not believe that this is the prime consideration. The ability of a tight firebox to increase efficiency and the amount of draft outweighs this, in my opinion.

ROBERT W. PIXLER
Vice President and General Manager
The Mettler Co.
Los Angeles, Calif.

Oversizing Heaters Is Solution To Too-Frequent Coil Cleanings

THE Data Sheet, *Hot Water Booster Heaters: What Every User Should Know*, by E. Spencer, in the November 1957 issue, explains what every user should know very well, with but two exceptions. These are: (1) the effect of dirty coils (scale accumulation), and (2) the method of sizing heaters. These factors actually are interrelated, as explained in the following.

The scale forming material dissolved in water obtained from ground sources tends to accumulate on coil surfaces as soon as heaters are put into use, unless the water is conditioned to prevent the formation of scale. Scale accumulation decreases the heat transfer rate and, therefore, rapidly reduces the output of heaters below rated capacity.

Unless oversized, heaters supplied with water that contains scale forming materials need to be cleaned much more frequently than once a year, as suggested in the Data Sheet, if water is to be delivered at the required temperature whenever needed. Piping connections should be provided to permit the addition and removal of inhibited solvent without removing the heater coils.

Oversizing of heaters would permit much longer periods between cleanings. The amount of oversizing depends upon the cost of the coil cleanings eliminated. The control valve and the piping do not need to be oversized because of the heater, although trap oversizing is good practice, as recommended by Mr. Spencer. Some extra heater capacity is desirable, also, to allow for the slight drop in water temperature through even the recommended short, well insulated hot water piping, and to allow for slowness in temperature regulator sensitivity.

R. A. PARSONS
Board of Water and Light
Lansing, Mich.

THE AUTHOR'S REPLY—Mr. Parsons' comments are quite appropriate. The effect of dirty coils could very well have been included in my article on booster heaters. This effect, however, varies widely with the locality and the characteristics of the water being heated, and should be considered by the manufacturer when supplying a heat exchanger for a user's requirements.

The fouling or scale factor which must be added when selecting a heat exchanger is usually determined from experience, although handbooks do give some general factors for well water, river water, etc. These general factors must be tempered by experience in the specific locality where the equipment is to be used.

Mr. Parsons is correct in indicating that, where scale formation is a factor, cleaning should be much more frequent than once a year. Where scaling is a major problem, oversizing of coils would probably merely decrease the frequency of cleaning, since it would probably not be economically feasible to install sufficient excess surface to compensate for serious scaling.

He suggests that the method of sizing heaters could well have been included in the article. It was decided that actual selection of the heaters themselves would be left out since it was primarily a function of the heater manufacturer.

E. SPENCER
Graham Mfg. Co., Inc.
New York, N. Y.

Pressure Piping Article to Spur Revisions in Piping Code

THE SCOPE of the article, *What to Consider When Designing, Fabricating Pressure Piping*, by Messrs. Murphy, Soderberg, Blumberg, and Rossheim, in January and in this issue, is much more inclusive of proper requirements than the American Standard Code for Pressure Piping (ASA-B31). It is, therefore, reasonable to look forward to revisions in the code after the provisions cited in the article have been studied.

The selection of materials is now generally presented to the designer in manufacturers' catalogs. Unfortunately, some variation in data usually exists between different manufacturers.

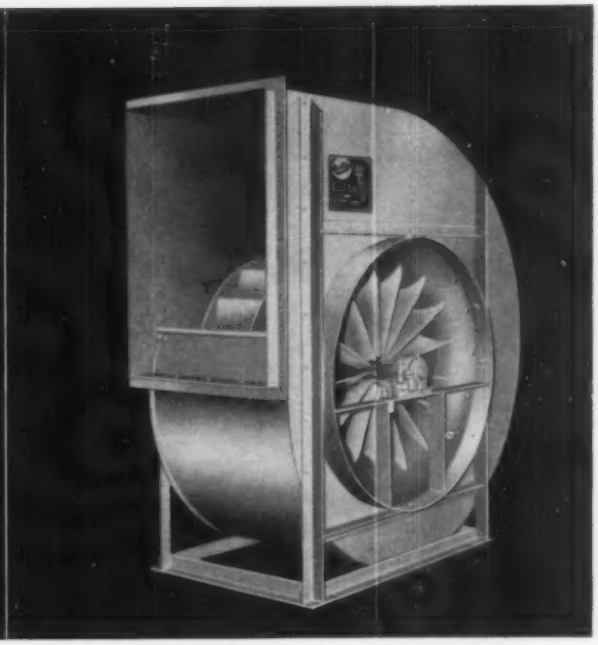
The authors indicate that there is a definite lack of information on piping and fittings made from nonferrous materials. We also need more information on new alloys for high and low temperature applications.

The paragraphs on grading and inspection are well pointed. Radiographic inspection could go far toward eliminating the use of unsuitable materials.

The operation of piping is certainly an important design consideration, and the authors have contributed much toward a better understanding of this. While many industrial plants have issued instructions for operating piping systems, there is still a lack of general knowledge of proper procedures.

L. E. PARTCH
Consulting Engineer
Wyandotte, Mich.

For Classes III-IV (High Pressures) The "Buffalo" Type "BLH" Fan



For Classes I-II (Moderate Pressures) The "Buffalo" Type "BL" Fan

FOR THE BEST ENGINEERED JOBS, SPECIFY BUFFALO "JOB-SUITED" FANS

For central system applications you don't have to accept a "compromise fan", loosely designed to cover any and all pressure requirements. "Buffalo" builds *two* fans, each engineered to fulfill specific pressure requirements to the highest possible degree. Brief engineering details on these "no compromise" "Buffalo" Fans are given below.

The "Buffalo" Type "BLH" Fan is recognized by engineers and contractors alike for its outstanding performance in Classes III and IV service. The "BLH" maintains an extremely high mechanical efficiency of 86% over a broad operating range. The smooth inlet bell with matching shroud, directional inlet vanes, backward-curved blades and divergent outlet all contribute to quiet operation and minimum turbulence. "Buffalo" engineering features, plus husky construction, add up to an efficient high pressure fan that will deliver long, faithful, maintenance-free service. When you plan a conduit system or other Class III-IV installation, be sure to specify the "BLH". Call in your "Buffalo" representative or write for Bulletin F-200.

The "Buffalo" Type "BL" Fan has gained wide acceptance for peak performance in major Class I and II installations throughout the country. Non-overloading, the "BL" provides quiet, stable, output from free delivery to shutoff. The smoothly-curved inlet bell, with directional guide vanes and matching shroud, assures minimum turbulence. Highest efficiency is attained by the streamlined wheel with backward curved blades, factory tested and balanced to hold vibration to an absolute minimum. The correctly shaped scroll of the wheel-contoured housing further contributes to smooth air flow. For full information on the rugged, reliable "BL" Fan for Class I and II conditions, contact your "Buffalo" engineering representative. Or, write direct for Bulletin F-104.

You get a *value dividend* with the "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life in *every* "Buffalo" product.

"Buffalo"

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Buffalo Pumps Division, Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Question of the Month

What Vapor Transmission Rules Apply When Planning for Dehumidification?

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. An earlier answer appears in the January issue. Other answers or comments for publication are invited.

"If we consider a sealed room, in which the air is at a low dew point temperature, and we suddenly open a relatively small door to the outside where there is a high dew point temperature,

"a) At what initial rate will water vapor enter the room per sq ft of opening?

"b) Does this rate vary with time elapsed after the door is opened? If so, what is the relationship?

"c) How can the time required for the entire room to reach outside vapor pressure be calculated in terms of room volume and dimensions? It is assumed that there is no air movement through the doorway and that inside and outside air are at the same temperature such as 85 F with an initial vapor pressure difference of 0.4 in. Hg.

"d) If it is now assumed that air flows outward through the doorway, at what velocity must it flow to prevent inflow of water vapor?

"Answers and comments from other readers on this will be greatly appreciated."—H. P. W.

Vapor Pressure Change Negligible If Door Is Not Open Too Long

AS FAR AS I KNOW, no specific answers are available on methods of computing what H. P. W. wants to know. The rate of migration of water vapor from an area of high vapor pressure to one of low vapor pressure is very difficult to calculate. However, some of our experiences with dehumidified warehouses may be of some assistance.

It has been our experience that a large warehouse maintained at a low dew point is not particularly affected by door opening if the length of time that the door is open is held to a minimum. We have come to the conclusion that very little difference in the vapor load occurs when air locks are used, in comparison to single door construction.

The rate of change in vapor pressure within a room is not only a function of the difference of vapor pressure between inside and outside. It is also a function of the materials from which the room is constructed and the equipment within the room. For instance, a metal building which is empty will equalize itself with outside conditions in a matter of minutes, but a building which is filled with hygroscopic materials such as wood, paper, and cloth may take days to come to the same vapor pressure as the outside.

The airflow rate from a low vapor pressure space to one of high vapor pressure will not affect the migration of moisture. This is because, under most conditions, the movement of water vapor is independent of the movement of air.

I suggest that a test be run of the particular facility if truly accurate answers are necessary. The Davidson Report for the Bureau of Ships and some reports available at the NAVCERLAB, Port Hueneme, Calif., may be of assistance.

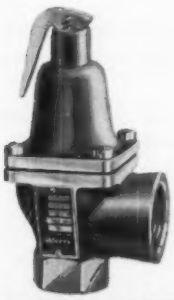
STUART GILES
Bemco, Inc.
North Hollywood, Calif.

Derive Vapor Transmission Rates For Steady-, Unsteady-State Conditions

THE CONDITIONS described by H. P. W. involve a process whereby vapor condenses from a gas-vapor mixture resulting from a partial pressure gradient. When this condition occurs, the vapor and gas temperatures change, due to sensible heat exchange between the respective fluids and to removal of latent heat from the vapor.

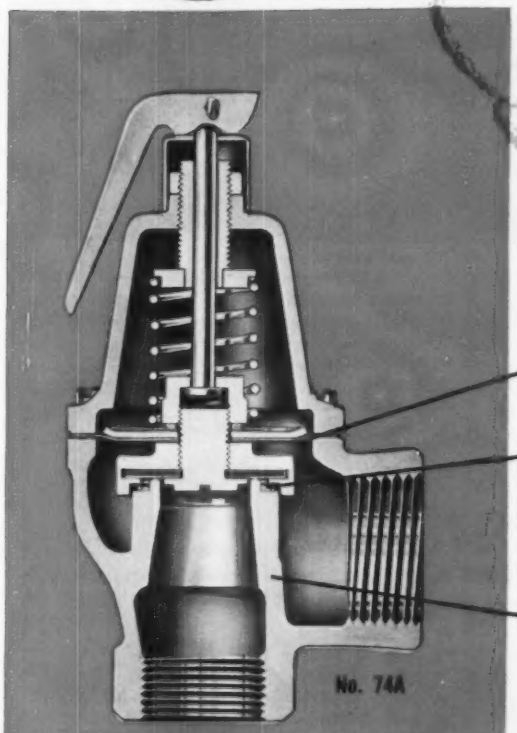
For a gas-vapor mixture such as air and water, vapor separation or removal is obtained by diffusion.

(*Continued on page 72*)



less than a PENNY

per Thousand BTU/HR



Watts A.S.M.E. Rated Relief Valves are available in capacities from 500,000 BTU/HR to 14,370,000 BTU/HR with valve settings from 30 to 150 lbs.

A.S.M.E. Rated Pressure Safety Relief Valves with

DOUBLE-SAFE DESIGN: No mechanical guides — not diaphragm actuated.

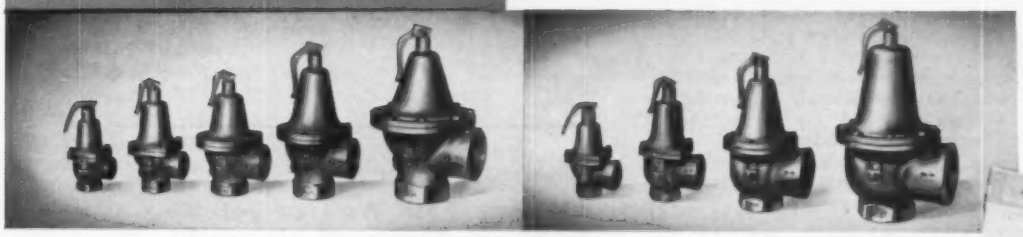
WATER SEAL: Provides precise alignment of seat to disc eliminating need of hazardous mechanical guides which can stick or freeze a valve shut from lime or corrosion.

STICKAGE-FREE DISC-TO-METAL SEATING: Heat resisting, stickage-proof silicone disc material.

POSITIVE POP ACTION OPERATION: Valves operate by pressure exerted directly against the disc to pop valve wide open for steam relief. Diaphragm rupture cannot cause valve failure.

CORROSION-RESISTING CONSTRUCTION: All parts constantly in contact with water are of commercial bronze. All other parts are of nonferrous material. No dissimilar metals used.

All these outstanding features are found in the Watts No. 74A and 174A, 740 Series valves. Buy Watts the line having double-safe features through advanced design principles. See your wholesaler.



For complete information on sizes, pressure settings, and relief capacities, **send for Folder F-ASME.**

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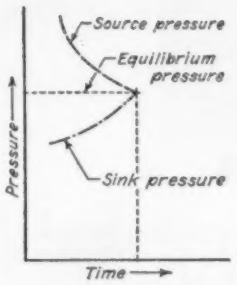
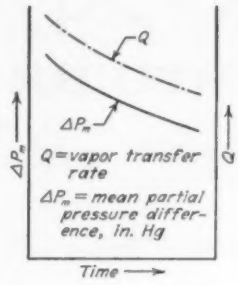
LARGEST AND MOST COMPLETE LINE OF ITS KIND IN THE WORLD



1 PRESSURE VARIABLES for air-vapor mixture for unsteady-state conditions represented graphically



2 VAPOR TRANSFER RATE with mean pressure difference as function of time indicated here

The hotter mixture transfers latent and sensible heats to the cooler mixture.

The rate of sensible heat transfer depends upon the mean temperature difference. From these relations it may be seen that vapor transfer is dependent upon mean pressure difference, whereas gas cooling is available from an exchange of sensible heat and is independent of mass transfer.

The following expressions show relations of the variables that govern dehumidification for steady-state conditions; wherein the source and sink pressures remain constant with respect to time.

$$Q = KA\ (\Delta P_m)$$
$$H_s = UA\ (\Delta T_m)$$
$$H_t = H_s + (QH)$$

where:

Q = vapor transfer rate, lb per hr
K = mass transfer coefficient, lb per hr per sq ft per in. Hg
A = area of diffusing surface, sq ft
ΔP_m = mean partial pressure difference, in. Hg
H_s = sensible heat transfer rate, Btu per hr
U = heat transfer coefficient, Btu per hr per sq ft per F deg
ΔT_m = mean temperature difference, F
H_t = total heat transfer rate, Btu per hr
H = latent heat of vaporization, Btu per lb.

Arranging this equation as: $Q/A = K\ (\triangle P_m)$ provides a means for answering question (a).

Assuming inflow of outside air and/or vapor to the sealed room does not occur, an unsteady-state or transient condition will exist, whereby the source pressure decreases and the sink pressure increases with time. For these conditions, mean pressure difference and vapor flow rate will decrease with respect to time and the latter will cease when pressure equilibrium occurs. The following first order differential equation may be employed to show these relations:

$$dQ/d\theta = -KA\ d\Delta P_m/d\theta$$

This equation answers question (b).

Fig. 1 is a graphical representation of these variables for an air-vapor mixture for unsteady-state conditions.

A plot showing vapor flow rate, Q, and mean pressure difference, $\triangle P_m$, as a function of time, θ, is indicated in Fig. 2. These relations show that the rate of change of flow rate with respect to change of mean pressure difference is constant and may be determined by the following:

$$dQ/d\Delta P_m = KA$$

The following is a derivation of an equation for calculating time required for the room to attain outside pressure, expressed in terms of room volume.

$$\theta = W/Q \quad \text{.....[1]}$$
$$W = PVG/(7000)RT \quad \text{.....[2]}$$
$$\theta = PVG/(7000)RTKA\ (\Delta P_m) \quad \text{.....[3]}$$

where:

θ = time, hr
W = initial weight of vapor in room, lb
Q = vapor transfer rate, lb per hr
P = initial vapor pressure, psf, absolute
V = room volume, cu ft
G = specific humidity, gr of water per lb of dry air
R = universal gas constant, ft-lb per lb per F deg
T = absolute temperature, R (460 + F)
K = mass transfer coefficient, lb per hr per sq ft per in. Hg
A = area of diffusing surface, sq ft
ΔP_m = mean partial pressure difference, in. Hg.

Using the values of temperature and pressure difference stated by H.P.W. and assuming values for P, R, G, and K, an equation for answering question (c) may be developed as follows:

P = 14.7 × 144 = 2120 psf absolute
R = 1544/18 = 85.6 ft-lb per lb per F deg
G = 117 at 64 percent relative humidity
T = 460 + 85 = 545 R
K = 0.017 lb per hr per sq ft per in. Hg
ΔP_m = 0.4 in. Hg.

therefore:

$$\theta = (2120 \times V \times 117)/(7000 \times 85.6 \times 545 \times 0.017 \times A \times 0.4) = 0.111\ (V/A)$$

H. B. WAYNE
Consulting Engineer
Woodhaven, N.Y.

READER ASKS —

"What's Best Way to Set Up Technical Reference Library?"

"Our consulting engineering office is in need of an organized system for filing technical literature. We want to know how to set up a system which would facilitate quick reference to all types of technical information."
—B.A.L.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

For pure, rust-free hot water, specify copper-lined heaters

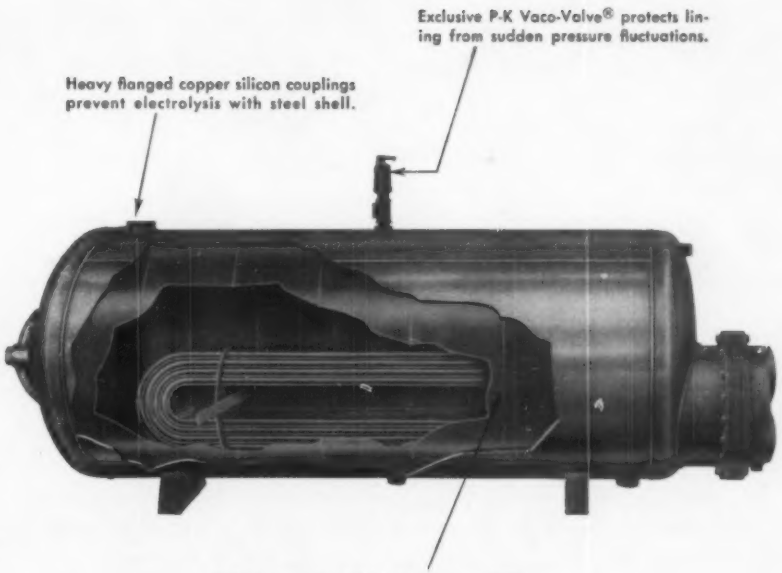
For guaranteed, trouble-free performance, specify P-K COPPER-LINED heaters

Copper-lined storage heaters assure a plentiful, pure, rust-free hot water supply. But a copper-lined water heater must also have the design and engineering features that assure long life and trouble-free service—and that's why so many engineers specify P-K Copper-lined Storage Water Heaters.

The P-K Copper-lined Heater is, in effect, two heaters in one. It is a copper shell built inside, and reinforced by, a heavy steel shell . . . combining the non-corrosive qualities of copper with the superior strength of steel. And wherever copper meets steel, the joint is protected against electrolysis by spinning copper over the tube sheet openings, or using copper silicon fittings for outside connections. Moreover, P-K testing procedures insure top operating efficiency—for every P-K Heater undergoes exacting hydrostatic and pneumatic tests that search out areas of possible failure.

In the past 40 years P-K has built more copper-lined heaters than any other fabricator. Thousands of them are installed from coast to coast, supplying users with an unfailing source of rust-free hot water and requiring only routine maintenance—proof of the soundness of P-K design and fabrication.

Put this experience to work for you by specifying P-K when you buy copper-lined hot water storage heaters. Meanwhile, get complete construction details, heating capacities, engineering and installation data by writing for P-K Data File #16 on copper-lined storage water heaters to The Patterson-Kelley Co., Inc., 2102 Warren Street, East Stroudsburg, Pa.


Exclusive P-K Vaco-Valve® protects lining from sudden pressure fluctuations.
Heavy flanged copper silicon couplings prevent electrolysis with steel shell.
Rolled expansion joints placed every 12" permit creep with temperature changes.

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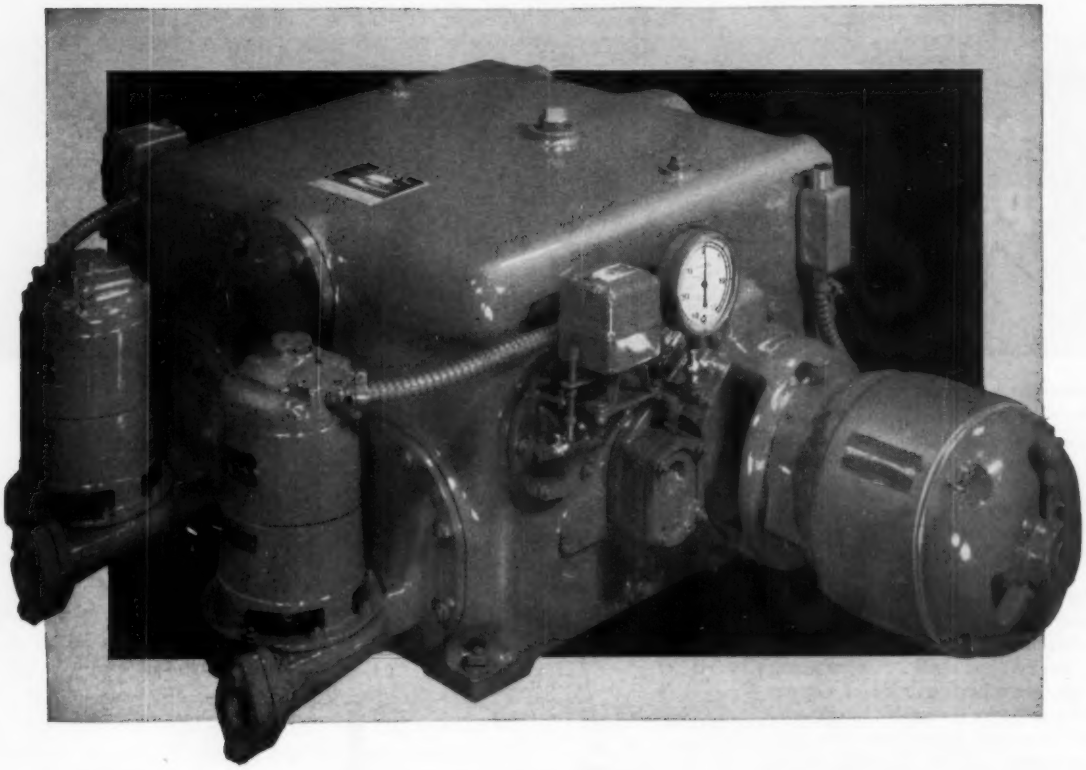
Storage Water Heaters • Instantaneous Heaters • Convertors • Fuel Oil Heaters • Freon Chillers and Condensers

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
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CEILING-HIGH WINDOWS embellish central heating, refrigeration plant to match prevailing modern architecture. Piping is color coded according to its use

Huge HTHW System Supplies Unique Heating-Cooling Operation

. . . at New York International Airport. Central plant delivers hot or chilled water to terminal buildings via underground piping. HTHW operates nine absorption refrigeration machines, marking its entry into the air conditioning field.

BY WILLIAM T. O'REILLY
Seelye Stevenson Value & Knecht
Consulting Engineers

NEW YORK CITY'S International Airport is a spectacular installation. This mile-long oval, formed by a periphery of buildings of the latest architecture, is a design achievement both functionally and appearance-wise.

But the beauty of this aerial gateway to the United States is more

EXPANSIVE AIRPORT comprises airline-owned terminal buildings, international arrivals building with adjacent airline wing buildings, 11-story control tower — all served year 'round by central HTHW plant

LAYING UNDERGROUND PIPING posed problem since most ideal depth was occupied by existing utility piping. Solution was found in special insulating procedure

than just skin deep. Its huge central high temperature hot water system marks the first time this type of plant has been called on to perform both heating and cooling functions. The system's vast piping network transports hot water for heating and chilled water for air conditioning to each terminal building.

In planning, it was decided that a central heating plant be constructed to supply all the buildings, and that a central refrigeration plant be incorporated into this plant.

This makes it possible for the various other buildings to eliminate all requirements for boiler rooms, fuel storage, refrigeration rooms, and cooling towers. (It also enhances the architectural design of these structures, since no smoke stacks, cooling towers, etc., are required to detract from their facades.)

Prior to designing the central heating and refrigeration plant two reports were studied.

One was a comparative survey of various thermal generation systems for space heating and the other was a design report on a heating plant for the central terminal area.

The conclusions of these reports led to the recommendation of a central heating plant of the high temperature hot water type, with an underground distribution system. These conclusions were based upon the following inherent advantages of the high temperature hot water system:

1) High thermal capacity, which permits the hot water type plant to absorb high peak loads without rapid load change reflecting immediately on the boiler firing rate, and which allows steady firing at high efficiency

2) Lower feedwater treatment cost and reduced internal pipe corrosion, because of the closed system and small quantity of makeup water

3) Elimination of return line corrosion

4) Simplified distribution system, with the piping following the ground contours and rising over, or crossing under, existing underground utilities.

Choose Absorption System

The selection of the refrigeration plant was largely influenced by the heating plant. It was initially intended that the refrigeration equipment be housed in each unit terminal building. This would have required electric drive machines. The imposed load of this heavy equipment on the existing transmission lines would have necessitated new utility feeders and additional switch gear. Therefore, a central plant was decided upon which would simplify the utility services and release considerable area in each unit terminal for more profitable usage.

The central refrigeration plant could be either steam turbine driven centrifugal machines or equipment of the hot water regenerated absorption type. The steam driven machines would have required a high pressure steam plant and high pressure hot water heat exchanger to meet the distribution requirements necessitated by the nature of the site.

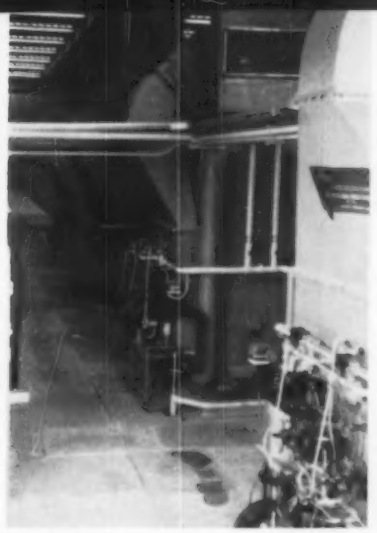
A high temperature hot water plant could serve both the absorption machines and the distribution system, still providing all its aforementioned advantages. With the concurrence of the manufacturer of the absorption units that his equipment could be regenerated with hot water, a central hot water heating with a central refrigeration plant was decided upon.

It is anticipated that there will be a connected cooling load of approximately 7250 to 7500 tons of refrigeration and a connected heating load of approximately 200 million Btu per hr.

As the unit terminals have different orientations, it is expected that peak loads in the various buildings will occur at different periods. Also, as the buildings will have 24 hr occupancy, no allowance is needed for pickup. These factors permit a diversification factor to be applied to the connected load to determine the plant load. This factor was arbitrarily set at 0.8, giving a total load as follows:

Cooling: $7500 \times 0.8 = 6000$ tons

. . . HTHW's cost saving features dictated its use



BOILERS are forced water tube type, each rated at 40 million Btu per hr

Heating: 200 million × 0.8 = 160 million Btu per hr

Existing Piping in the Way

The underground distribution system was installed in reclaimed land, made by hydraulic fill and consisting of an average of 9 ft of sand over a peat meadow mat approximately 2 ft thick and underlaid with sand. The normal grade is 14 to 16 ft above sea level. The water table is about 4 to 6 ft below grade.

Certain utility piping and conduit existed in the area prior to the decision to provide a central heating system. Storm and sanitary sewers have an invert elevation of 9 to 11 ft, and their sizes range 15 to 48 in. in diameter. Cold water and fire service piping is located about 4 ft below grade. Electric conduit is situated with a bottom of structure elevation of approximately 9 ft and about 2 ft in height with widths varying from 3 to 10 ft.

Therefore, the desirable location for the underground hot water piping — 9 to 12 ft — was occupied by other services.

To meet this situation, the underground hot water piping had to be installed in a conduit system capable of withstanding the effects of being submerged below the water table, with resulting ill effects to insulating qualities and corrosion resistance. A number of conduit systems were reviewed. The one selected was a pulverized natural asphalt.

To insure the satisfactory performance of this material, it was pre-cured or set into three zones — plastic, sintered, and unconsolidated — while the trench was open and before backfilling. This was done by the use of a portable steam generator. It permitted observation that the desired structural qualities had formed in the asphalt and that the water resisting properties had set.

The chilled water mains run adjacent to the hot water main, separated by about 2 ft. To compensate for the heat given off by the hot pipes and the expected temperature of the earth surrounding them (60 to 70 F), a minimum of insulation was placed on the chilled water piping. Expanded plastic was installed, which, as an insulation, is both inert and water resistant. For corrosion prevention, the pipe was factory coated with a saturated asphalt felt. The plastic insulation was field applied with a bitumastic compound over the covering and provided additional corrosion protection.

Boilers Heat Water to 400 F

The four boilers are of the forced water tube type, each capable of producing 40 million Btu per hr when heating 570 gpm of water from an entering temperature of 240 F to a leaving temperature of 400 F. Water is circulated through the boiler by a 570 gpm centrifugal pump. A spare pump is provided for each set of two boilers.

Each boiler is arranged for firing with a positive pressure in the furnace and is equipped with dual fuel burners. It is fitted with two forced draft air registers, each with a variable capacity mechanical pressure, steam assisted atomizer for burning No. 6 oil, and a gas ring for burning 1000 Btu per cu ft natural gas. A pushbutton gas-electric ignition assembly with programmed start and flame failure protection is provided for each boiler.

An electric combustion control system of the full metering type is provided with master regulation of the firing from the pressure in the expansion drum. The system consists of the following equipment for each boiler: Oil flow element, gas flow element, oil-air ratio control, gas-air ratio control, transfer switch, power units (oil valve, gas valve, and forced draft damper), recorder (water flow and temperature entering and leaving boiler), recorder (Btu and air flow), and draft gages (windbox, furnace, and uptake pressures).

In addition to the safety controls provided by the flame failure system, the burners are shut down automatically for such abnormal condi-

tions as stopping the forced draft fan, low water in the expansion drum, low water flow through boiler (via auxiliary switch in flow meter), and high differential pressure across the boiler.

All these abnormalities stop the burners, sound an alarm, and light up the appropriate signal on the annunciator board.

To provide steam for the burners and the fuel oil heater, a water-to-water evaporator or steam generator is provided which will generate 60 psig steam. All makeup water for the steam generator is taken from the deaerating heater.

The oil heating and pumping set is a duplex arrangement with one pump and one heater normally operating and one pump and one heater as a standby. Under light load conditions, the excess oil handled by the pump is bypassed back to the day tank by the adjustable pressure relief valve in the pump discharge. The suction heater in the day tank is for startup only. Under normal operation, the valves for this heater are closed.

Expansion Drum Meets 2 Needs

The expansion drum on the mezzanine floor serves two purposes. First, its primary duty is to absorb the expansion and contraction surges of the system. Second, it is an accumulator and stores heat to even out load variations on the plant. It acts as a water reservoir from which both the boiler circulating and district circulating pumps take their suction. The tank is not sized to take the full expansion of the water from a cold start, but rather to take up only the normal changes in water temperature during ordinary operation.

The tank is equipped with the following: Overflow control, consisting of an external cage float box with pneumatic pilot to control a pneumatic overflow valve (The discharge of the valve is piped to a blowdown separator where the water is flashed, ejecting the steam through the roof and the water to the blowdown tank.); blowdown valves to remove sediment and solids from the bottom of the tank, piped to blowdown separator; internal distributing head to distribute the water to all sections of the tank and minimize differential temperatures; illuminated gage glass and remote level indicator at boiler instrument board (The remote level indicator has two mercury tube switches to signal high water and low water. A low water signal stops all burners and the hot water district distribution pumps.); water level control, consisting of two magnetic float switches to start and stop the makeup water feed pumps; and the necessary safety valves, vents, and gages.

The makeup feed pumps are two positive displacement power pumps rated 20 gpm each. These pumps are sized well in excess of the anticipated normal leakage. Only one pump will run at any one time, with an alternator changing the sequence of operation.

The water softeners are designed to deliver 30 gpm of zero hardness water to the deaerator and makeup feed pumps. The softeners consist of duplex tanks with a common brine tank and feature automatic regeneration and metering.

The chemical feed tanks and pumps provide for the internal treatment of the heating system water. The tank is split into two sections; one side facilitates the addition of oxygen scavenging chemical (sodium sulphite) which is fed directly to the suction of the makeup feed pumps, the other provides for scale inhibiting chemicals and pH control.

Fuel System Keeps Tank Filled

Fuel oil bulk storage consist of a 5000 barrel spherical tank, above grade, complete with suction heater, gages, and other equipment.

Delivery of oil is made by tank truck. Operational supply is transferred from the bulk tank to the day tank by transfer pumps. The operation of the transfer pumps is semiautomatic as follows:

The day tank has an electronic level signaling system, with three electrodes indicating three stages of operation. When the lowest electrode signals low oil in the day tank, an alarm sounds at the annunciator panel. The operator manually starts the fuel oil transfer pump by pushing the start button of one of the pumps. (Only one pump is run at any time, with the other as a standby.) When the oil has filled the day tank to the level of the second electrode, the transfer pump shuts off automatically. If, due to some malfunction, the oil level continues to rise, the third electrode signals "high level" by sounding the alarm at the annunciator panel.

A temperature controller on the suction heater in the bulk tank maintains the flow temperature of the oil at approximately 100 F. The suction heater in the day tank is required only for startup and is manually controlled. This heater is normally valved off and the necessary heat for transport provided by the recirculated oil.

Oil heating is accomplished through the use of high temperature hot water. In all cases, the water is at a higher pressure than the oil to avoid contaminating the water with oil. To offset any unpredictable condition where contamination may occur, a safety device in the form of an oil filter with an electronic oil detector is installed. Should oil contaminate the water, the alarm sounds and the filter removes any oil that is present, giving sufficient time to valve off the lines before the damage can spread.

The gas meter is a high capacity unit and is located in the meter house adjacent to the bulk oil storage. With it is included a security or emergency shutoff valve and a pressure regulating valve.

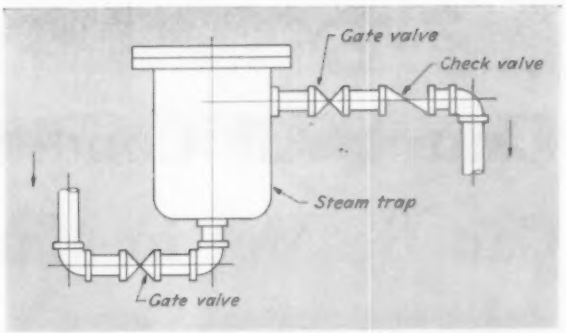
A break-glass switch for the security valve is located in the boiler house at the rear door. In the event of emergency, the main gas supply can be shut off by this switch.

How the cooling load is balanced, how the water distribution system functions, and how the overall system serves unit terminals will be described in an early issue. ∓

Photo on page 76 courtesy American Gilsonite Co.

Accessories Improve Steam Trap Arrangement

BY G. W. HAUCK
Manager, Engineering Sales
Crane Co.



1 SIMPLE STEAM TRAP ARRANGEMENT is workable but does not provide quick way to ascertain if trap is functioning properly or improperly

HERE are a few piping additions that are of value to any steam trap piping hookup.

The simple arrangement for a steam trap in Fig. 1 is workable, up to a point. The trouble is that it's too simple. There's no quick way to ascertain if the trap is working, or if it is functioning improperly.

The arrangement is improved — Fig. 2 — with the addition of a few items, each of which contributes its share toward longer life, uninterrupted service, simplified maintenance, and a quick means to check the trap's performance.

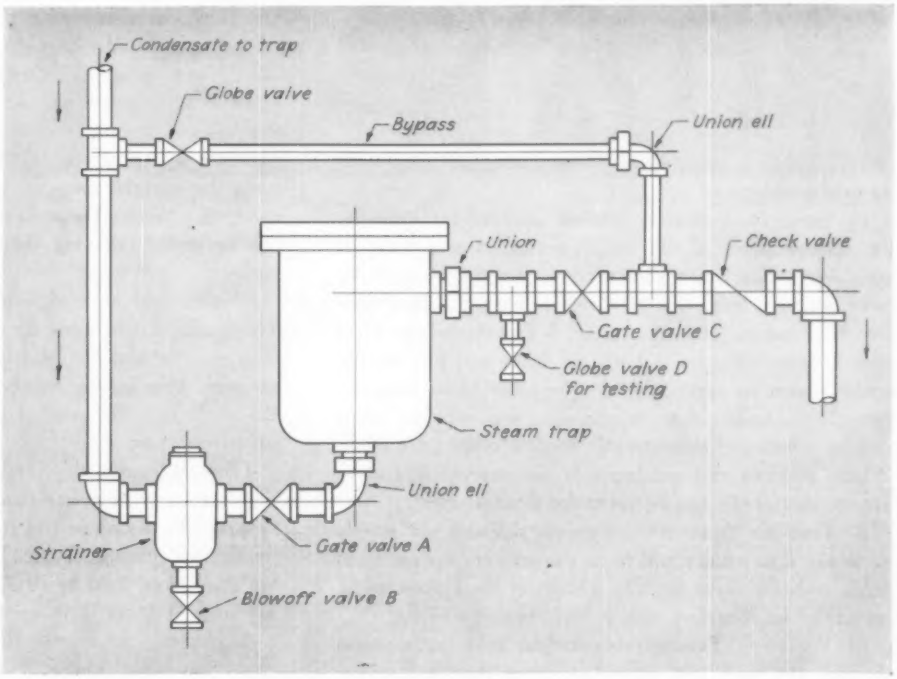
A strainer with a blowoff has been installed ahead of the steam trap. This is good insurance against the ravages of foreign matter in the piping.

The bypass permits uninterrupted service. The bypass line with its globe valve makes it possible to remove condensate by hand throttling while the trap is out of service. Simplifying one maintenance operation justifies the bypass.

With this piping hookup, steam traps can be checked at regular intervals to ascertain if they are operating properly. Shut gate valve *A* and open blowoff valve *B* to see if any condensate is coming to the trap. Close gate valve *C* in the outlet line, and open test globe valve *D*, to observe the operation of the trap. If the trap is functioning properly, there will be no flow of water between periods of discharge, nor will there be any discharge of steam. ⧺

The author is a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors and has prepared numerous articles for publication in its pages.

Other articles on piping hookups will be published in the future. Previous articles were in the September through December 1957 and January 1958 issues.



2 IMPROVED ARRANGEMENT, with the addition of such accessories as a strainer, a blowoff valve, and a bypass with globe valve, simplifies maintenance, provides uninterrupted service, and permits regular checking of steam traps

Church Air Conditioning Needs Can Be Met in Many Ways

Evaporative cooling, well water, cold water or ice storage, and various refrigerating methods are used with success, the right choice only being made after careful analysis. Infrequent hours of use and heavy construction impose extra loads when systems are started, and allow storage of some cooling effect to meet peak demands. Peak loads on Sunday require proper distribution of cooling to rooms occupied by shifting groups.

BY DAVID C. BRIGGS
Consulting Engineer

and

W. R. WOOLRICH
Dean, College of Engineering
University of Texas

MORE CHURCHES are including the investment cost and operating expenses for air conditioning in their budgets as they become aware of its benefits, which include improved attendance, increased offerings, reduced street noises and dust infiltration, and greater efficiency of staff workers.

Face Special Problems

The design of church air conditioning presents some unusual problems:

1) Since most church systems operate infrequently, the storage effect of the building and fixtures must be considered. The heavy construction, plus the mass of the pews, stores a large quantity of heat energy, either positive or negative. When the system is first started, an extra load is imposed upon it until the walls and fixtures are cooled down to approach an acceptable room temperature. If precooling time is available, some cooling effect can be stored and subsequently used to offset peak loads. Where services run continuously for several hours, no appreciable credit can be given for storage effect.

2) Cool air from relatively low sidewall air supply outlets in a sanctuary will form a layer over the occupant level, and the warm air will remain at the higher levels, especially in churches with a high peaked ceiling.

3) For single floor sanctuaries the heat transmission through the wall area extending more than 5 ft above the outlets may be omitted, but the solar heat gain through all of the glass area must be included. One-third of the heat gain through the roof may be omitted except as the ceiling temperature affects the amount of radiation that might be transmitted from the surface of the warm ceiling to each individual.

4) Since most churches have limited funds, every effort to achieve economy in both installation and operating costs is usually necessary. Large economies can be gained by: (a) zoning so that small capacity equipment cools the various zones in succession as they are being used; (b) thoroughly analyzing the various cooling methods to insure selecting the one with the lowest overall cost.

5) Churches have high peak loads of short duration. This peak load is made up of the Sunday morning worship service and the widely spread out church school sessions. Usually the number of other services through the week and the number of people involved are comparatively small.

The peak load of the Sunday morning program in itself requires study to assure that adequate cooling effect will be properly distributed to rooms that are being occupied by shifting groups. Typically, the Sunday school rooms are used from 9:30 to 10:30 a.m., and the main sanctuary from 11:00 to 12:00 noon.

A church can usually be divided into four zones:

(Continued on page 82)

. . . six different systems serve these churches

Capitol Methodist, Phoenix

First Baptist, Austin

University Methodist, Austin

Seats	280	1100	Sanctuary 1100 School 1500
Tons	20 equiv.	60	130 (30, 50, 50)
Type	Evaporative (two units with 2 hp motors)	Ice, 6 ton bunker	Direct expansion, chilled water; zoned
Cost	$1337.40 excl. ducts, diffusers	$9000	$100,000
Date	August 1953, during construction	June 1950, in existing building	Summer 1956 after construction
Serves	Sanctuary, 12 hr per wk	Sanctuary, 14 hr per wk (11-12 a.m. and 7-8 p.m. Sun., 7-8 p.m. Wed.)	Sanctuary 15 hr Sunday Offices, daily School, 3-10 hr Sunday
Operating Expense	$4.50-$18 per mo, power	$4000 per season, ice Note: church plans to construct entirely new building soon.	———

St. Andrews Episcopal, Houston

University Presbyterian, Austin

St. Edward's Catholic, Dallas

Seats	200	1000	400
Tons	23	60	30
Type	Package units (5, 5, 5, 5, 1, 1, 1)	Accumulator, 8 ton capacity, with two 15 hp condensers	Direct expansion, one 30 ton condenser
Cost	$7500, incl. new heating units	$39,500	$20,000
Date	April 1955, after construction	March 1953, during construction	April 1954, in existing building
Serves	Sanctuary, 5 hr per wk Assembly, almost daily	School, 9:30-10:30 a.m. Sun. Sanctuary, 11-12 noon, Sun. plus occasional times Offices, daily System operates 6 hr per wk	Sanctuary, sacristy, choir, vestibule, 9 hr per wk
Operating Expense	$64 per mo maximum, power	$430 per season, power Note: In hottest weather, ice not sufficient to cool school and sanctuary. System actually designed to serve only sanctuary, and is satisfactory for purpose.	$250 per season, power

Sunday school, sanctuary, social hall, and administrative space. As the administrative space is generally used daily, it should be conditioned by a separate system. Small meeting rooms used at odd times during the week may sometimes be included in the administrative zone. For most churches no two of the remaining zones are used at the same time. In some cases proper zoning can reduce equipment required to one-third of that which would otherwise be required.

Various Methods Prove Successful

Systems that have been successfully used in the U.S. to meet churches' needs include:

1) *Evaporative cooling.* This method is especially applicable in the Southwest. Systems that do not saturate the incoming air with water vapor are often installed. Since all input air is from the outside, no provision for air return is required. This method is effective when the wet bulb temperature remains below 70 F. Air velocities should be kept within a maximum of 150 fpm, and incoming air should be at least 30 cfm per person.

2) *Spring or well water circulated through unit cooler coils.* This is practical in cooler climates where water of relatively low temperature is abundant and costs little.

3) *Ice water circulated in cooling coils.* One of the most successful methods in hot climates for 20 years, this method is now being superseded in many areas for reasons of economy. The installation cost for an ice system is usually low, but the daily operating cost is generally very high. An ice system can be operated satisfactorily without a special attendant. This method has much merit especially where only one or two services are held in the sanctuary each week.

4) *Vapor compression system with a well insulated cold water storage tank.* This type will cool a small sanctuary and church school a few hours a week at a very low investment. It consists of a low tonnage compression unit, a well insulated water tank equipped with adequate cooling coils, a circulating pump, space cooling coils, and essential controls. This system has proved successful in some smaller churches in warm climates where available tap water was much too warm to do effective cooling.

5-6) *Vapor compression or absorption systems with ice storage tanks.* To justify this accumulator system in preference to purchased ice generally requires a higher use factor of the space to be cooled. The higher investment can be justified only when the cost of the summer purchased ice would more than offset the extra investment and operating cost of the mechanical system.

In this system, during the long period between church services, water is frozen in a tank by refrigeration pipe coils or plates connected to a small condensing or absorption unit. Whenever air cooling is required, a circulating pump automatically distributes water over the accumulated ice bank and then through the cooling coils within the sanctuary.

A church plant that would otherwise require a 40 ton compressor might conceivably use a 10 ton unit, accomplishing in 8 hr of prior machine operation what the 40 ton unit would do in 2 hr at church time. This system avoids high demand charges for electricity.

There is a trend today to adopt this type of system in the warmer climates of the U. S.

7) *A mechanical refrigeration compressor system capable of serving the entire cooling demand at any time.* To keep the condenser water cost down, a water cooling tower is recommended.

If a compressor for full cooling demand is used, the remainder of the system equipment must likewise be of equivalent capacity.

8) *Packaged air conditioning units.* A battery of 3 to 5 ton air cooled units throughout the church reduces ductwork, eliminates water cooling costs, and avoids high electric demand charges. In the cooler spring and fall months, not all the units are necessarily operating, thus holding electric demand charges to a minimum as the weather permits.

9) *An absorption compression system capable of serving the entire cooling demand at any time.* This method

TABLE 1—INSTALLATION COSTS for air conditioning typical Texas church sanctuaries with different cooling systems and seating capacities shown here range from $150 to $1140 per ton and from $8 to $81 per seat

Tons	Seats	Cost	Date bid let	Church	People per ton	Cost per ton	Cost per seat
				DIRECT EXPANSION			
10	200	$ 7800	May '52	Hallettsville Methodist, Hallettsville	20	$ 780	$39
15	300	6067	July '54	West Austin Baptist, Austin	20	405	20
15	350	5070	Sept. '54	Furman Avenue Church of Christ, Corpus Christi	23	338	14
30	400	10,490	April '54	East Avenue Baptist, Austin	13	350	26
30	600	19,137	Sept. '51	Trinity Lutheran, Austin	20	638	32
30	600	18,000	March '52	Church of The Good Shepherd, Austin	20	600	30
40	600	14,000	July '53	Downtown Baptist, Corpus Christi	15	350	23
55	1000	26,500	April '55	Ayres Street Church of Christ, Corpus Christi	18	463	27
75	1300	31,853	Jan. '55	First Baptist, Killeen	17	425	24
				Average	18	$ 485	$27
				CHILLED WATER			
30	500	$ 17,568	Feb. '55	Tarrytown Baptist, Austin	17	$ 586	$35
50	700	57,000	July '54	St. Luke's Episcopal, San Antonio	14	1140	81
80	750	60,000	June '54	Travis Street Methodist, Sherman	10	750	80
				Average	14	$ 774	$65
				ACCUMULATOR			
60	1000	$ 39,500	March '53	University Presbyterian, Austin	17	$ 658	$40
60	1100	27,000	June '53	First Methodist, Austin	18	450	25
225	3000	116,755	July '51	Travis Park Methodist, San Antonio	16	519	39
				Average	15	$ 505	$36
				ICE			
60	1100	$ 9000	June '50	First Baptist, Austin	18	$ 150	$ 8

may be more expensive than others of equal capacity, but the operating cost is generally considerably lower. These units operate quietly and are often gas fired.

Air conditioning by the absorption system is generally provided in a year 'round cooling and heating system, since heat is the source of energy for both.

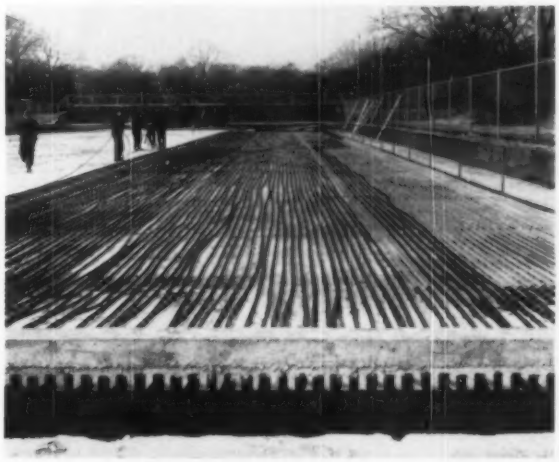
The extra cost of the full capacity compression systems — whether by the mechanical or the absorption method — may be justified when the entire capacity is required or anticipated many hours per week. Increased use of the church in summer with the introduction of an adequate cooling system may make the difference between the economy of a limited or a full capacity installation investment.

Expansion of the refrigeration capacity for future needs should be provided for, as reports of increased church and Sunday school attendance after air conditioning justify the long look in planning.

The actual choice of the system depends upon the particular church and the quality of performance desired. When the system is to be installed during the church construction the most important considerations are first cost and the utility rate structure. If the system is to be installed in an existing church, the cost of remodeling may be the determining factor. The cost of air conditioning several representative churches is shown in Table 1 on the facing page.

Although general conclusions about church air conditioning are helpful, each installation still presents an individual problem which can be solved only after a careful consideration of the factors involved in the specific application. ∓

Plastic Piping Serves Portable Ice Rink



PIPING is laid in long rows by maintenance personnel, left, while ends are connected to header, right. Piping is removed, re-installed seasonally, so site has summertime uses

THE BUFFALO ICE CASINO at Humboldt Park, Buffalo, N.Y., is a typical portable, outdoor, artificial ice skating rink using plastic piping.

The 185 × 85 ft installation has a refrigeration system comprised of 50,000 ft of 1 in. flexible polyethylene pipe, which is laid the length of the rink, and two 50 ton compressors. Ice thickness is maintained at 1 to 2 in.

The feature of the rink from the users' standpoint is its portability. The piping is laid directly on the ground, with no concrete slab required. At the end of the skating season it is removed and stored, by three maintenance men in about two days' time, and the rink site is free for summer activities.

In the fall the piping is re-installed within three days.

To facilitate this portability, plastic was selected as the piping material due to its lightness in weight and ease of handling and installation.

The rink has capacity for about 500 skaters. It operates between mid-November and mid-March.

Since the piping is relatively unprotected, damage from extremely rough handling and leaks caused by ice skate cuts can occur. But this only rarely happens and any necessary repair has been an easy matter.

The system will operate until the outdoor wet bulb temperature reaches 45 F. The normal operating pressure on the rink piping is 20 psi, although it has been tested to 50 psi.

The rink cost $100,000.

C. A. Meadows & Associates was the consulting engineer. The piping contractor was Mellenberg Betz. ∓

Photos courtesy Republic Steel Corp.

Boilers, Compressors Go "Top Side"

Dedicated this month, new Chicago Sun-Times building features heating, air conditioning plant located on upper floors. System provides year 'round comfort through perimeter, interior zone setup.

HEATING AND AIR CONDITIONING the new Chicago Sun-Times building required considerable planning. Some unusual decisions were made during the design phase of this new $15 million plant and facilities located on the north bank of the Chicago river.

One of the features of the installation is the location of the boilers and air conditioning compressors and fans. Since it is necessary to bring newsprint paper into the building at the river and railroad track level, the usual basement space for mechanical equipment is not available. Therefore, it was decided to install this equipment near the top of the building.

The two 500 hp, combination gas and oil fired, low pressure, scotch marine boilers are on the seventh floor. Two 700 hp compressors are on the ninth floor. All fans are located on the seventh, eighth, and ninth floors.

As the boilers are operated under forced draft conditions, stub stacks projecting only a few feet above the roof are adequate for removing the products of combustion from the boilers.

Store Alternate Fuel

Natural gas is available on an interruptible basis for year 'round use. Since the local gas utility may cut the gas supply any time the load is excessive, provision has been made for supplying an alternative fuel, Bunker "C" oil, on 30 minutes notice.

Four 12,500 gal oil storage tanks are buried in concrete vaults under

In Newest Newspaper Plant

the building. Each tank, 9 ft in diameter and 25 ft long, has two manholes—one for access and the other for a special 16 in. welded, oil-tight hot well. Each hot well has a 12 kw, low density, thermostatically controlled electric heater to maintain the oil temperature at 120 F. The oil suction lines from these hot wells are welded to the top of the hot well and terminate there. This makes the hottest oil available at all times.

The oil suction and return lines run out to the basement into headers and are cross-connected and valved so that any tank can be used from this location. The hydrostatic fuel oil gages are mounted at this point, also, so as to enable the operator to observe the fuel position of each tank at any time.

A prefabricated oil pumping and straining set is installed adjacent to this area. This unit, comprised of a set of duplicate oil pumps, has a capacity of 7.6 gpm at 125 psi. Each pump is driven by a 2 hp motor. Starters and contactors for the oil pumps and four tank heaters are installed in a steel enclosed cabinet. Pilot lights indicate which tank heaters and oil pumps are in operation.

A similar prefabricated heating and straining set is also located in the boiler room. This unit consists of two steel, straight tube, steam heaters, each of full oil pump capacity, and two 9 kw electric heaters.

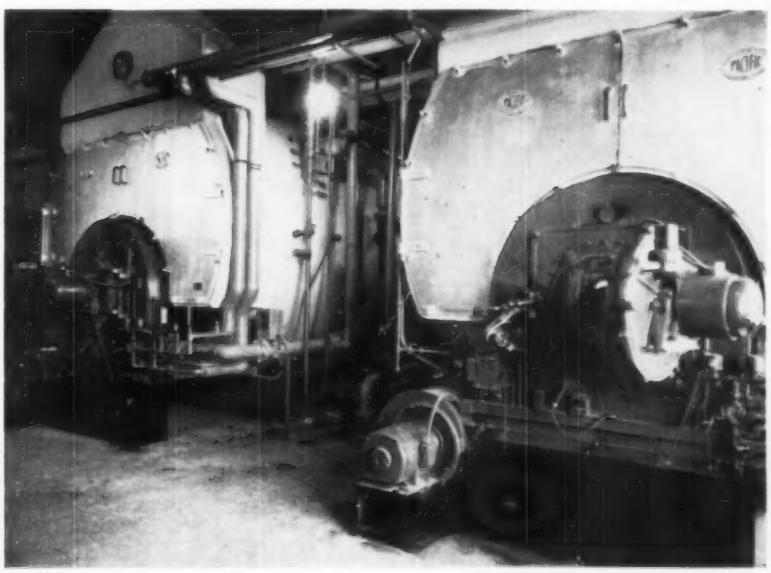
The steam heaters are thermostatically controlled by a pilot type steam temperature control valve set to maintain an oil temperature of 180 F. The two electric heaters are also thermostatically controlled. Oil delivered to the burners passes through a duplex discharge strainer. Each heater has a relief valve and a three valve bypass. The steam heaters and the electric heaters are cross-connected so that their use may be interchanged.

The oil piping is a complete circulating loop from the oil tanks to the pumps, heaters, and burners, and back to the tanks. This system is flexible, to permit the oil to be circulated and heated, regardless of whether the oil burners are operating or if the system is burning natural gas.

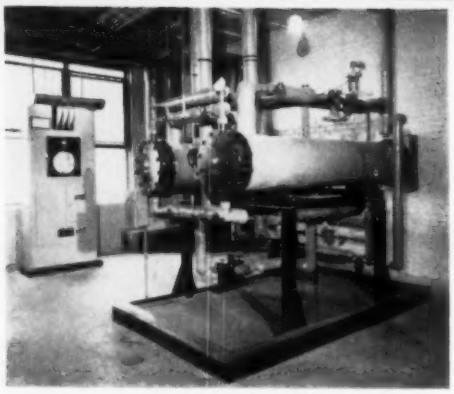
Easy Fuel Changeover

The combination gas-oil burners are of the horizontal rotary type, with special arrangement for forced draft operation. Since gas is the major fuel, a steel register is provided that imparts a spin to the air and forces it to mix with the gas. This prevents any possibility of stratification or improper combustion. A stainless steel multiport gas ring furnishes gas to the boiler.

When a gas burner is operating, the oil burner is swung out of firing position. The gas piping is completely welded and is arranged so that it does not interfere with swinging the oil burner open or closed. Whether firing oil or gas, the gas ring and gas



BOILER INSTALLATION consists of two 500 hp, gas-oil, low pressure, scotch marine units. Burners are designed so that when gas burner is operating, oil burner is swung out of firing position. Feature facilitates easy fuel changeover



OIL HEATING, STRAINING equipment in boiler room includes two steam heaters, duplex discharge strainer. Also shown is one of two control cabinets

piping remain unchanged. Changeover from gas to oil, or vice versa, is accomplished in about five minutes. Each oil burner is direct driven by a 5 hp motor and is provided with a 5500 cfm forced draft fan. Operation of the combination gas-oil burners is fully automatic.

Steam pressure is maintained at 10 psi at all times. Each boiler is equipped with an automatic water feeder, low water cutoff, limit pressure control, modulating pressure controller, and modulating motor. This modulating motor provides low fire starting and modulation on either fuel.

A safety control system includes a transistor which scans the gas pilot on ignition. If the pilot is operating satisfactorily, the main gas valve or oil valve is permitted to open. At the end of the pilot cycle the pilot is shut off and the transistor continues to scan the main flame. This facilitates an instantaneous noncycling shutoff.

An alarm is sounded if flame failure occurs. Low water level also shuts off the burner and sounds an alarm. The burner resumes operation when the boiler water level returns to normal.

Heat, Cool Via Same Units

Heating and air conditioning of the building is accomplished by means of the same units. Each floor above the first floor is divided into two zones: interior and perimeter.

High velocity induction units are supplied with chilled water for air conditioning and with hot water for heating. These year 'round units serve the perimeter zones, which are 12 to 16 ft in from the outside walls. In this system, centrally conditioned primary air is supplied from the seventh floor fan room. This air is delivered into the rooms through adjustable diffusers in the window sills. Room air is mixed with primary air as it passes over the coils.

The interior zones, or those areas within the perimeter zones, are supplied with conditioned air from ceiling diffusers. Five large fan systems on the eighth floor deliver this air, at velocities around 5000 fpm, through rectangular ducts.

The air supplied to both the perimeter and interior systems is returned to the fan rooms and either exhausted or recirculated. As the temperature rises in the return ducts, the controls vary the temperature of the supply air to the interior spaces to satisfy the desired setting.

River Provides Water Supply

Two centrifugal refrigeration compressors, each driven by a 700 hp electric motor, supply the cooling capacity by chilling water to 42 F. Water is returned to the chillers at 54 F under full cooling load.

River water is used for condensing. The temperature of this water during the summer is about 75 F, so no cooling tower is necessary. The water is admitted to the building through a rotating screen which keeps fish and debris from entering the pipes and pumps.

All water entering the building, except that used for the air conditioning condensers, is treated by means of a magnetic induction unit installed in the 8 in. water line. Treatment is accomplished by passing the water through concentrated magnetic fields so that salt crystals—normally formed when water is heated—are precipitated out so that they do not adhere to the piping, boilers, tanks, etc. Corrosion and scale formation are prevented in this manner.

Filter Ink-Laden Air

The press room, reel room, and paper storage areas are supplied with suitably conditioned, filtered, outdoor air the year 'round. Specially designed filters are installed which clean the air of ink mist thrown off by the high speed rotary presses. These filters consist of special paper media on rolls. The rolls automatically re-position the media as ink builds up.

Teamwork Speeds Completion

Excellent cooperation between the architect, consulting engineer, all the contractors, and the trades resulted in having the building ready for occupancy well ahead of schedule. This cooperation was aided by weekly conferences which were attended by all contractors. The architects' superintendent presided as chairman. The meetings consisted of a briefing regarding the particular items of construction scheduled for the next week. Contractors were able to ask questions pertaining to their phase of the work, so that all would understand the operations involved. In this way, many difficulties, conflicts, and the overlappings which can occur in projects of this type were minimized or avoided. The contractors all felt that they were well repaid for the time invested in these meetings.

The heating and air conditioning systems were designed by Naess & Murphy, Architects and Engineers. Kroeschell Engineering Co., heating, piping, and air conditioning contractors, installed the boilers, pumps, piping, and heating systems. The perimeter air conditioning system including the chilled water and condensing water piping system was installed by the William A. Pope Co. The ventilating systems were installed by the R. B. Hayward Co. and Jamar Olmen Co. Mid-West Heat Service, Inc. installed the combination gas-oil burning system, controls, and fuel oil storage tanks. ⧺

What to consider when . . .

Designing, Fabricating Pressure Piping

In January the authors reviewed current pressure equipment practices and established four degrees of quality of pipe butt welding. Here, they describe four construction classes, and, via the comprehensive Table 2 on pages 89, 90, and 91, break these down according to design, materials, fabrication, and inspection requirements. Table 1 in the January issue gave weld qualities for the four classes of pipe.

BY J. J. MURPHY*, C. R. SODERBERG, JR.**, H. S. BLUMBERG***, and D. B. ROSSHEIM****

TABLE 2 extends the four classes of pipe butt welding quality into four construction classifications. Each represents an attempted optimum association of design, materials, fabrication, and inspection requirements for maximum avoidance of either overemphasis or inadequacies. In other words, they are four optimum balanced levels of fabricated piping. The weld qualities presented in Table 1 are not repeated in Table 2 but constitute an important part of the overall piping classifications.

This tabulation represents a first concrete attempt to bring together present-day understanding of pressure equipment behavior as exemplified by boiler and pressure vessel experience on the one hand, and background with piping design and service on the other.

Classes I and II are fully examined with design details and materials selected to assure a definite quality, while Classes III and IV involve a degree of quality control and selection of design and material sufficient to assure an average and not a prescribed minimum quality of the level indicated. The joint factor for butt weld strength is omitted, as are any credits for radiographic examination and stress relief. The term "joint efficiency" has been so abused as to be meaningless, and should be restricted to joint designs, such as lap welding, which do not uniformly develop the full strength (static or fatigue) of the parent material. Credit for nondestructive examination and thermal stress relief as construction factors has provided too restricted coverage for meaningful classes of construction. Coherent classes of construction must weigh the variables of design, materials, fabrication, and inspection for assembly into meaningful levels of quality.

Selecting Construction Class

As stated in January, "maximum overall economic safety" must associate a level of fabricated pressure piping construction with the demands of a specific application. In the many industries which are concerned with pressure piping these may assume different complexion or importance, but in general involve the following factors.

1) Service
   a) Pressure and temperature, including provisions for their limitations
   b) All variations in pressure and temperature, including their duration and frequency
   c) Maintenance and reliability
   d) Hazards attendant to release of contents
   e) Dynamic conditions involving rate of change, such as smoothness and variation of operation, upsets, rapid surges, and startup conditions
   f) Proximity to operating platforms, control houses, and offices
2) Piping system characteristics
   a) Piping size and thickness
   b) Complexity and extent of significant localized stress, and the number and nature of branches and restraints
   c) Basis for and completeness of design
3) Materials
   a) Weldability
   b) Air or work hardening characteristics
   c) Enhancement of properties by quench and temper, precipitation hardening, normalize, and temper
   d) Sensitivity and stability under conditions of corrosion, oxidation, and metallurgical changes
4) Fabrication and erection
   a) Degree of restraint
   b) Degree of position welding
5) Location
   a) Relative to other plants
   b) Relative to roads or streets
   c) Relative to dwellings

Some of these factors are not presently subject to classification and, therefore, can be meaningfully assessed only by individual study. On the other hand, some treatment of the many factors which do involve quantitative or qualitative significance is possible. Even where this is lacking, measurable benefit can be ob-

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This article is adapted from a paper presented at the American Society of Mechanical Engineers Petroleum Mechanical Engineering Conference, Tulsa, Okla., September 22-25, 1957.

tained from organized association and weighing to common bases and/or defined basic principles.

An attempt to accomplish such an organized basis for pressure piping is presented as a part of Table 2. This relates the four classifications of pressure piping with severity of service demands as to operating requirements, complexity of geometry, sensitivity of materials, and hazards to surroundings.

Table 2 is limited to ferrous materials and to nickel base alloys. Aluminum and copper and their alloys and nickel-cobalt alloys, have been omitted in the interests of brevity, although the same fundamentals apply.

Materials are now commonly viewed on a strictly "go" or "no go" basis. They are either acceptable and good for unlimited service, or rejected as unfit for any pressure equipment application. More precise design, lower safety factors, and increasingly severe services justify material quality approaching perfection or a much less satisfactory radically increased thickness to attain a maximum level of safety and reliability.

Progress in securing superior materials has resulted from the insistent demands of critical services, in particular the high pressure and high temperature main steam lines of large size utility power plants. The codes recognize quality only as to limitations on grades.

It is essential that material quality be in step with design, fabrication, and inspection. For the highest classification of pressure piping, assurance of uniform chemistry and absence of harmful segregation, inclusions, or contaminants is justified. Similarly, the physical properties should be sufficiently assessed and reflect the entire pipe area as a minimum, and not an isolated standardized test location. Microstructure, in particular grain size and uniform structure or phase, is becoming increasingly significant with relation to fabrication and high temperature properties and also to fatigue resistance.

Pipe specifications are unique among material specifications in defining harmful defects, and in providing supplementary requirements for premium quality. In this definition laps, slivers, and cracks are not considered harmful if their depth, as determined by exploratory grinding, does not encroach on the minimum wall thickness. The first step in establishing defect limits is in need of refinement and extension to several grades of piping quality.

Only on castings do the codes presently provide a quality factor, which is a function primarily of the degree of nondestructive or destructive examination, or the proving of the pattern and casting technique of ASA standard fittings by quantity production. Wider specification coverage for mandatory and optional nondestructive examination is now, or soon should be, economically feasible, with recent developments in continuous automatic defect scanning equipment using ultrasonic or magnetic principles.

The reproducibility of materials of uniform high temperature strength has not been widely investigated. Only in a few critical applications have creep rupture tests been required for production heats. Certain materials, particularly the austenitic steels, are subject to a lowering of high temperature strength and embrittlement, as the result of phase changes under temperature.

Experience Provides Material Response Data

The importance of a wide fundamental knowledge of material response to extreme temperature and attendant hot working has been more and more appreciated in recent years. Increasing demands, generating from service involving higher temperatures, pressures, and capacities, have provided valuable experience. With the manufacture and fabrication of heavy wall thickness high alloy steels and alloys, some new problems have been introduced which have assisted measureably in extending our knowledge of old ones.

Of particular importance is the influence of temperature and time. The exploration of this promises to aid in understanding the role of welding temperature and rates of cooling on the resulting structure of the heat affected zone of base material, as a factor in promoting cracking adjacent to welds in austenitic steels.

Projects at Rensselaer Polytechnic Institute have developed equipment capable of reproducing a time-temperature pattern in simulation to the local temperature cycle attendant to the heat of welding. This has permitted association of specimen test results with fabrication and service behavior. The equipment shows encouraging promise of future ability to pre-evaluate sensitivity to cracking adjacent to welds or in hot working, or its elimination by control of contributing influences.

Code Limitations, Needs Apparent

This article has been limited to a very broad consideration of fabricated pressure piping. It precludes any specific conclusions or recommendations. However, certain essentials must be appreciated for a logical association of fabricated piping construction details with service demands of specific installations of "maximum economic overall safety."

The limitations of present code objectives and of existent code content are very apparent.

The ASME Unfired Pressure Vessel Code, paragraph U-1 (a) reads:

"The rules in this section of the code, cover minimum requirements for the design, fabrication, inspection, and certification of unfired pressure vessels."

The Introduction to the 1955 ASA B31.1 piping code also establishes that code as a "standard of minimum safety requirements." It is the authors' understanding that the next edition of this code will also be subject to the same limitations as the pressure vessel code.

Code construction, therefore, establishes only the minimum new construction quality which applies equally to the least hazardous and most rigorous services. No guidance is provided for the evaluation or significance of local stress, so that permissible details of design,

(*Continued on page 91*)

TABLE 2—FOUR QUALITIES of pipe butt welding extended into four construction classifications, or optimum balanced levels of fabricated piping. For weld quality data, refer to Table 1 on page 163 in January issue

Item				FABRICATED PIPING CLASSIFICATIONS (For balanced design, material, fabrication, and inspection)			
1. General				I	II	III	IV
	Applicable to	Services	Which are	Critical	Severe	General	Non-hazardous
		Materials		Sensitive	Carbon and alloy steel and Ni alloys	Carbon and certain alloy steels	Carbon steels
		Assemblies		Complex	Complex	Average	Simple
2. Limitations							
	Service	Maximum pressure		No restriction	1500 lb ASA std.	See "Contents"	
		Maximum temperature F		No restriction	1200 F	750 F	300 F
		Minimum temperature F		No restriction	No restriction	-50 F Ferritic -150 F Austenitic	Ambient
	Materials	Maximum thickness for ASME Section IX Table QB, 1 grouping of materials	Group P-1	No restriction	XX or Sched. 160	XS or Sched. 100 with 1.25 in. max.	XS or Sched. 80
			Group P-3	" "	Sched. 100	Sched. 40	Not permitted
			Group P-4, P-5	" "	Sched. 80	Not permitted	" "
			Group P-8	" "	Sched. 80 with 0.75 in. max.	Sched. 40 with 0.5 in. max.	" "
			Other groups	" "	Sched. 80	Not permitted	" "
			High strength low alloys	" "	Not permitted	Not permitted	" "
			Nickel alloys	" "	Sched. 80 with 0.75 in. max	Sched. 40 with 0.5 in. max.	" "
			Super alloys	" "	Not permitted	Not permitted	
		Materials with enhanced properties	Air hardened	" "	" "	" "	" "
			Precipitation hardened	" "	" "	" "	" "
		Max. U.T.S. (psi) (Min. spec. value)		" "	75,000	75,000	75,000
		Minimum ductility, percent		15	15	15	15
	Contents	Lethal or radioactive		No restriction	Not permitted	Not permitted	Not permitted
		Toxic		" "	Permitted up to Sched. 40	" "	" "
		Noxious or hazardous on contact		" "	Permitted up to Sched. 100	" "	" "
		Flammable		" "	Permitted	Permitted up to Sched. 60	" "
		Non Flammable	Gas or liquid above atmospheric flash point	" "	"	" "	Permitted up to Sched. 40
			Liquid below atmospheric flash point	" "	"	Permitted	Permitted
3. Design							
	Limitations for branch connection reinforcement D = Pipe run dia., d = branch dia.	Reinforcement Distribution		As necessary to meet max. stress intensification factor	Per ASA Piping Code		
		Integral local reinforcement - full penetration welds		Permitted if welds can be examined with full interpretation	Permitted if welds can be examined adequately	Acceptable	Acceptable
		Ditto - inclined nozzles				Acceptable within ASA Code limits	
		Fillet welded local reinforcement plates, saddles, etc.		Not permitted	Not permitted for d/D 0.5	Limit to max. d one size under D	Limit to max. d one size under D
		Complete cylinder reinforcement around pipe run		" "	Not permitted	"	"
		Tees, flued connections, equivalent integral fittings		Acceptable	Acceptable	Acceptable	Acceptable
		Butt welded insert (reinforcement integral)		"	"	"	"
		Full penetration, corner weld	Reinf. in neck or pipe run, Weld axis normal to pipe run	Not permitted	Not permitted	"	"
			Reinf. in neck or pipe run, Weld axis inclined to pipe run	" "	Acceptable	"	"
		Alternate details permitted by code		" "	Not permitted	"	"
	Flange types	Butt welded		Acceptable	Acceptable	Acceptable	Acceptable
		Van stone		"	"	"	"
		Slip-on		Not permitted	Not permitted	"	"
		Socket welded		" "	" "	2 in. max.	"
		Threaded		" "	" "	12 in. max.	"

TABLE 2 (Continued)					I	II	III	IV
	Pipe joints	Butt welded			Required	Required	Acceptable	Acceptable
		Socket welded			Not permitted	Not permitted	2 in. max.	"
		Threaded			" "	" "	12 in. max.	"
	Gaskets	Solid metal, metal jacketed or retained spiral wound			Required	Required	Acceptable	Acceptable
		Compressed asbestos			Not permitted	Not permitted	500 F max.	"
		Other non-metallic			" "	" "	Permitted to 500 F if suitable	"
	Limitations as to pipe manufacture	Seamless			Acceptable	Acceptable	Acceptable	Acceptable
		Elect. resistance, flash or pressure welded			Acceptable with full examination		"	"
		Fusion welded					Acceptable with spot examination	"
		Lap welded			Not permitted	Not permitted	Acceptable	"
		Butt welded			" "	" "	4 in. max.	4 in. max.
		Continuous welded			" "	" "	8 in. max.	8 in. max.
	Acceptable details for structural attachments	Contour of intersection with pressure pipe			Surface of revolution and same requirements as for branch connections for this class	Above 750 F same as I	Basic designs similar to acceptable branch connections	
						750 F or below same as III		
		Attachment to pressure pipe			Butt or integrally welded same as for branch connections for this class	Same as for branch connections of similar basic design		
4. Material								
	Pipe and fittings	Identification (each length)	Spec. & grade		Required	Required	Required	Required
			Heat no.		"	"	Not required	Not required
		Examination for soundness Note: check I.D. same as O.D. where diameter permits	Visual		Required for entire O.D. & entire I.D. with mirrors		Required for entire O.D. and I.D. from ends	
			Ultrasonic	For locating harmful defects	Required	One of these examinations required over entire O.D. surface	Not required	Not required
			Magnetic particle		Required for mag. material		" "	" "
			Penetrant oil		Required for non-mag. material			" "
			Radiographic	To aid assessing defects	Required		" "	" "
			Welded long seams		See Item 6			
		Supplementary tests	Micro exam.		Required for each length	Required for each heat treatment lot	Not required	Not required
			Check analysis		Required for each heat	Required for each heat	" "	" "
			Contaminants check		" "	" "	" "	" "
			Check for main identifying elements		Fabricator to check each length	Fabricator to check each length	" "	" "
			Fatigue test		Required for each heat treatment	Not required	" "	" "
		Injurious defects	Cracks		Not permitted	Not permitted	Not permitted	Not permitted
			Scabs, slivers, seams, laps, tears, abrasions, mechanical marks		" "	Must be removed within min. wall thickness	Must comply with ASTM specs.	
			General surface conditioning		" "	Not permitted		
			Repairs by welding		Permitted by fabricator only with all welding requirements for class			
		Corrosion Deterioration and impairment			User responsibility with code guidance			
	Electrodes	Identification	Spec. & class		Required	Required	Required	Required
		Chemical analysis and bend test			Required each heat and container	Required each heat and container	Not required	Not required
	Enhanced strength materials				Ample heardness checking to assure uniformity	Not used	Not used	Not used
5. Fabrication & Erection								
	Requirements for butt welds (circ.)				See Table 1			
	Branch connections and attachments	Root, joint details and fit-up			Equal to requirements for circ. butt welds			
		Weld surface & nondestructive exams			" " " " " " "			
	Longitudinal seams	Root, joint details and fit-up			" " " " " " "			
		Weld surface & nondestructive materials			" " " " " " "			
	Destruction test to verify materials and technique				Desirable	Desirable	Not required	Not required

TABLE 2 (Continued)					I	II	III	IV
		Fatigue test of weld			To be included in destruction test		Not required	Not required
		Qualification of	Procedure		Interchangeable with destruction test; otherwise every 6 months		Every 12 months	Every 12 months
			Operator		Not required with specified non-destructive examination		" " "	" " "
	Thermal treatment of welds		Preheat (min.)		Per welding procedure qualification			
			Post heat treatment		Required for optimum service properties	Desirable	Per welding procedure qual. (if required)	Not required
	100 percent Prespring	For service over 750 F	(For austenitic steels, must be accomplished by strain measurement)		Required for all materials	Required for austenitic steels and nickel alloys		
5. Inspection & Tests								
	Material				See Item 4			
	Circumferential butt welds				See Table 1			
	Inspection for branch and attachment welds				Equivalent to requirements for circ. butt welds			
	Inspection for longitudinal welds		Fusion welded		Same as for pipe (item 4) except full radiographing		Spot radiog. 1 per 50 ft	Per ASTM spec.
			Electric resistance flash or pressure		Same as for pipe plus one reverse longitudinal bend test from ea. end of ea. length		Per ASTM spec.	
			Lap, butt, continuous		Not permitted			
	Leak Tests		For detecting minute leaks (Halogen or equal)		Required for lethal radioactive, toxic or noxious service		Acceptable alternate for required test	
			Low pressure air or inert gas		Required for other services		Acceptable; required for flammable contents	Acceptable alternate for required test
			Liquid test at 1.25 x design pressure		Permissible but does not substitute for required test		Required where other test not made	Required
	Structural verification		Check of required and actual thickness of principal pressure parts		Required	Required	Required	Required
			Extent of examination inherent in class to verify fabrication soundness		Complete nondestructive examination	Complete radiographing & supplementary surface exam.	Spot radiographic exam.	Visual
		Pressure test	Type	Hydrostatic	Acceptable	Acceptable	Acceptable	Required
				Air or inert gas	"	"	Only with special precautions	Not permitted
			Test required		Either one application of pressure at 1.25 x design pressure or 5 applications of pressure at design pressure (5 minutes minimum each)			

The following sections of Table 2 have been omitted from the authors' original:

a) Under item No. 2, Limitations, the number of service cycles.

b) Under item No. 3, Design, the basic allowable stresses at and above ambient temperature, and the local reduction factors. Also, the local stress factors, the allowable stress range for cyclic loadings, and consideration of temporary abnormal and emergency loadings.

c) Under item No. 4, Material, provision against brittle failure for ferritic steels.

(*Continued from page* 88)

fabrication, materials, and inspection represent rather independent and limited weighing of their individual significance, without the benefit of a common parameter, in contrast to balanced construction. This approach must result in wasteful refinement for nonhazardous applications, and incomplete safety for critical services.

The characteristics peculiar to schedule size piping fabrication — extreme curvature, appreciable diameter, thickness and concentricity variations, and access for welding or inspection limited to the OD — have not as yet been recognized by adequate code provisions for design and fabrication and fully suited nondestructive inspection techniques. Areas of extreme local stress are common in even relatively simple piping systems, and rapid changes in temperature and/or pressure accompany variations in flow or the operation of valves. The resulting repetitive strain range is further augmented by restrained thermal expansion, requiring a fatigue approach for predictable and effective use of materials and fabrication.

Four basic qualities of pressure piping butt welds result from available fabrication techniques and nondestructive examination.

Class	Description
I	ID machined pipe ends — full examination
II	Mill pipe ends — full examination
III	Mill pipe ends — random examination
IV	Mill pipe ends — visual examination

These classes are subject to certain variations in detail and quality. With requirements established on a consistent level for each class, it is then possible to continue the same basic degrees of quality, as defined by stress intensification potential, into four classifications of fabricated piping; each representing a balanced selection of fabrication, materials, design, and inspection. It is logical to associate these classifications with service severity as interpreted by fatigue potential and a judicious appraisal of hazard to life and property in the event of failure. ≠

4 STEPS TO AIR CONDITIONING

Once the problem of air conditioning a building has been defined, the remaining steps—evaluating the thermal load, designing for extreme conditions, and designing control for partial loads—can be taken with comparative ease, using empirical engineering methods.

FOUR STEPS are taken by the engineer in the design of an air conditioning system. The first and most critical of these, it was determined in my article in the January issue, is defining the problem; that is, evaluating the outside conditions affecting the structure and determining the desired inside conditions.

Once this has been accomplished, the remaining steps are, in their order of occurrence: the evaluation of the thermal load, the design of the system for extreme conditions, and the provision of control for all operating conditions.

Evaluating Thermal Load

The engineer can apply relatively simple and accurate analytical and empirical methods for evaluating the loads which will have to be met by the air conditioning system—whether for heating or cooling. Total equipment load will include fractions due to transmission, ventilation, and sources or sinks located within the conditioned enclosure. From the engineering standpoint, an item of major importance is the distribution of total load between that due to direct heat transfer (the sensible fraction of total load) and that due to the mass transfer of water vapor (the latent fraction of total heat load).

Load evaluation is essentially a technical problem. Though it is sometimes time consuming, it is one which the engineer can readily handle. It is a problem for which he must, and can, accept full responsibility, within the limits of accuracy of the conditions selected in defining the problem.

Designing for Extreme Conditions

With the various critical loads established, the next problem involved is that of selecting equipment components, and combining them into a workable and controllable system.

In carrying out this task, the engineering problems involved are similar to the problems associated with any other thermodynamic system or with a typical heat power system. The usual step-by-step requirements are:

1) To provide an energy source for winter heating, or an energy receiver for summer cooling. The usual energy source is a fuel, whereas the energy sink is ordinarily provided by some type of refrigeration system.

2) To transfer energy into or out of the sink or the receiver. This step involves basic heat transfer relationships. For air conditioning applications the fluid velocities may differ from those used in industrial processing, but the principles remain the same.

3) To store energy within the fluid which is used as a working substance. This step is based almost entirely on utilizing internal kinetic energy or internal potential energy as a readily variable thermodynamic property.

4) To transport the working substance which carries (as steam or hot water) or which is subsequently to carry (as liquid refrigerant) the energy that leaks into or out of the conditioned space. Here, the design procedure for piping, tubing, or a duct system follows standard engineering methods.

5) To transform the energy from its method of manifestation within the conditioned space to or from the storage form which is desired within the working substance. This process is one which finds special application in air conditioning.

Energy transformation in practically all types of air conditioning systems can be treated in terms of the concept of a wetted surface. Whether that surface is a cooling coil on which condensation occurs or is an air washer makes no essential difference, since the effective transfer boundary is the interface between the water surface and the passing air-vapor stream.

With a coil the process is more often one which approaches steady state. The fluid within the coil is either delivering or carrying away energy at a fixed rate.

With an air washer the droplet temperature obviously must change as energy is either received or rejected. At high water-to-air flow rates, however, (as in a scrubber) the energy transferred per droplet is so small compared to the thermal capacity of the droplet that the droplet does not undergo appreciable temperature change. In this case the air washer approaches steady state operation and the process of conditioning is identical to that which occurs on a wetted surface.

DESIGN

BY F. W. HUTCHINSON
Professor of Mechanical Engineering
University of California

The following critical conditions show the wide applicability of the wetted surface concept:

a) When the temperature of the wetted surface is below the dew point temperature of the approaching air-vapor stream, there will be mass transfer of vapor molecules from the air to the surface, with condensation at the surface. The latent heat liberated due to condensation will then undergo heat transfer through the surface. Sensible heat transfer will occur from the air stream to and through the surface. Thus, sensible heat and mass are transferred to the surface, while total load heat transfer occurs through it. The system cools and dehumidifies the air through use of an external heat sink.

b) When the temperature of the wetted surface is equal to the dew point, no mass transfer occurs, and the sensible heat transfer to and through the surface is equal to the total load. The system cools the air at constant humidity and utilizes an external heat sink.

c) When the temperature of the wetted surface exceeds the dew point but is less than the wet bulb temperature of the air, there is mass transfer from surface to air and sensible heat transfer from air to surface. The total load transferred as heat through the surface is then equal to the sensible heat load less the latent heat load. The system cools and humidifies the air stream through use of an external heat sink.

d) When wetted surface temperature equals air wet bulb temperature, the system operates adiabatically. Sensible heat transfer to the surface equals the latent heat needed to provide mass transfer from the surface. The system cools and humidifies the air stream without use of an external source or sink.

e) When wetted surface temperature exceeds air wet bulb temperature but is less than dry bulb temperature, there is sensible heat transfer from air to surface and latent heat loss (by mass transfer) from surface to air stream. Total heat load flows to the surface from within the wetted surface (droplet or coil) in amounts equal to latent load less sensible load. The system cools and humidifies the air through use of an external source. Heating is required though air temperature is reduced.

f) When wetted surface temperature is equal to air dry bulb temperature, there is no sensible heat transfer between surface and air. In this case the system humidifies the air at constant temperature. The total heat supplied to the surface is then changed to latent heat and passes to the air stream by mass transfer. An external heat source is required.

g) When wetted surface exceeds air dry bulb temperature, there is both heat and mass transfer from surface to air. The total heat supplied to the surface must equal the sum of sensible and latent heat loads. This system heats and humidifies the air through use of an external source.

The wetted surface concept is by far the most widely used method of energy transformation that enters into air conditioning design. It is subject to limitations in certain areas of the psychrometric chart and is subject to mechanical difficulties when a wetted coil is used for humidification.

6) The final step necessary in designing the system for extreme conditions is to distribute the conditioned air within the occupied space. This process is one which has been treated in very large measure by essentially empirical methods.

Providing Control for Partial Loads

Once the system has been designed for extreme conditions, the engineer must carefully evaluate its ability to perform under partial loads or under conditions for which the sensible to total heat load ratio may have either very small or very large values.

Control components are available which can be utilized in constructing practically any desired type of system control. The choice and the arrangement of controls vary greatly in terms of the type of system and the anticipated degree and rate of load change.

A good control arrangement must be sufficiently economical to justify its first cost. However, effectiveness rather than price must be the guide in selection of the components. Inadequate control can nullify all other efforts by the engineer to provide a good system, can greatly increase operating costs, and can lead to an uncomfortable environment during periods of reduced load.

Objective Responsibility Easier

As can be seen from this brief discussion, the technical processes which constitute an air conditioning system are readily determined by precise engineering evaluation. Once the air conditioning problem for a proposed structure has been defined, the competent engineer will have little difficulty in designing a system which will meet the requirements of the conditioned space at all thermal loads up to and including the extreme values which were selected as a design basis. Therefore, the objective part of the engineer's responsibility — the analysis, selection, and arrangement of the equipment which is to constitute the system — is one which can be performed with ease and accuracy. ≠

CENTRAL CONTROL BOARD, via its signal lights and air pressure gages, relays operation of zone valves. Thermometer indicates building temperatures at 48 points. Here, Thomas Barrett, building superintendent, actuates a main valve switch, while Joseph K. Blum, who designed board, looks on

Modernization is Answer

Plush Waldorf spared no expense in giving its guests a "hot time." But present owner had existing extravagant steam system modernized, had building air conditioned throughout.

BY LEWIS SMITH
Heating Engineer

WHEN COMPLETED in 1931 the 2000 room Waldorf-Astoria Hotel represented the ultimate in luxury, comfort, and service to its guests. That it still maintains this reputation as far as New York City is concerned is exemplified by the fact that not a single hotel has been built in that city since then to challenge this lofty position. When designing the original heating plant it was decided that, as an important part of the comfort and service, the guest was to have all the heat he wanted all the time.

Hence, no heat control system was included in the original installation. A conventional two pipe vacuum return line system was used with copper convectors in all guest rooms. The piping was arranged in several horizontal zones fed by low pressure risers. All public spaces had separate steam supply for heating and ventilating those spaces individually. Steam pressure was maintained 24 hours a day.

While this made it possible for the guest to have plenty of heat at all times, it also resulted in serious overheating. This was especially true in milder weather and proved to be a major source of complaint.

The steam consumption was high, but its cost was considered legitimate if it provided service to the guests.

New Owner More Practical

When the Hilton Hotels Corp. became the owner in 1949 a modification of the previous policies was put into effect. While service and guest comfort were still paramount, the cost of rendering this was to be kept under control as much as it could be, without sacrificing comfort.

As a first step in this direction, steam was shut off during part of the night. While this did effect a cost saving, each morning when the steam came on there was objectionable

SIMULTANEOUS DRILLING from inside wall speeded process. One complete installation could be made in 8 hr day. In four months 450 units were installed

INSTALLING an "in-the-wall" unit required cutting rectangular hole through wall to house wall sleeve. Operation was accomplished using abrasive cutting wheel, electric hammer

To Hotel's Heating, Cooling Problems

noise generated by piping and convector expansion and some water hammer. Therefore, the practice had to be discontinued.

Use Existing Piping Layout

This lead to a study of the whole problem of control. Recommendations by the retained consulting engineers were that advantage be taken of the layout of the original piping to divide the transient guest rooms and tower apartments into 10 zones, each of which could be individually controlled. The public spaces already had independent control systems.

It was realized that a straight *on-off* control would intensify the noise problem. Therefore, this type was not considered. On the other hand a continuous flow control would require orificing of 5000 convectors.

A compromise was reached which retained the good features of each type. Two valves were installed for each zone; one to supply full heat and to be automatically controlled, and the other, a smaller bypass type, to supply sufficient steam to keep the piping hot. The bypass valve normally remains in the full open position but it, too, is a fully automatic unit. When operating conditions warrant, this valve, operating automatically, remains fully open, partially open, or fully closed.

The automatic control selected consists of a combination of outdoor and indoor thermostats for each main valve. This combination is adjusted so that the valve seeks to maintain, by opening and closing, an average radiator temperature in conformance with the outdoor temperature and wind velocity.

The pneumatic control system includes some 6000 ft of copper tubing.

A control center is located in the superintendent's office on the seventh floor. From the signal lights and air pressure gages on this board the operator is aware at all times of the operation of the zone valves. Also, there is a thermometer which, via push buttons, indicates building temperature at 48 points. A recorder registers the temperatures in the principal public spaces.

Means are provided so that the operator can alter the automatic control if he finds from his temperature readings that correction is required. Both the main and bypass valves can be manually operated. Time clocks close the main valves at midnight and open them at 6 a.m. The bypass valves, continuously open, eliminate noise when the main valves open.

Realize Steam Saving

This installation was completed during 1955. The saving in steam is running over 13 percent. The improvement in guest comfort and satisfaction is attested by the fact that, whereas complaints were numerous

before the controls were installed, there are practically none today.

Cooling is Economic Necessity

While modernizing the existing heating system, the Hilton management was also fully aware of another problem, i.e., the loss of revenue in the summer due to the absence of any cooling in guest rooms. The only air conditioning provided in the original building was a 300 ton installation for the grand ballroom. So, a study was inaugurated of ways and means to overcome this situation. At the same time it became imperative to extend air conditioning to include all public spaces.

The first step in this direction was the installation of a 1000 ton unit for all the public rooms. The original 300 ton unit was used to supply cooling to 350 bedrooms up to the 17th floor, making use of some existing vertical shafts originally designed for ventilation of the Grand Central railroad terminal tracks which run under the hotel, together with hung ceilings already available for ducts on certain floors.

Install "In-the-Wall" Units

Conditioning the rest of the guest rooms and tower apartments wasn't this easy. It would have been necessary, if a central system were to be used, to install a conduit system or fan-coil units using chilled water under the windows. In either case, this would have involved changing from a steam to a hot water heating system. It would have meant considerable disturbance to guests, as well as extensive redecoration of rooms.

Therefore, considerable interest was aroused in a proposal to install self contained heating and cooling units of the "in-the-wall" type in each room.

An experimental unit was assembled and installed in the superintendent's office to test performance and to develop methods of installation. It was one which would be connected into the existing steam lines for heating and contain its own compressor and air cooled condenser. The results proved satisfactory and today 1000 such units are installed.

In most of the rooms there were two convectors behind metal panels extending the full widths of the rooms. In each of these rooms, one convector was replaced with the cooling unit which contained a new integral heating element.

Preliminary calculations showed that the maximum cooling load would be 8400 Btu per hr, but units having a capacity of 10,620 Btu per hr, driven by 1 hp motors, were selected in order to provide extra cooling capacity when guests arrive.

Cutting an opening through the outside wall to accommodate the integral sleeve for housing the equipment was done as follows: The convector was removed first. Then a man on the inside cut out the brick at the same time as a man on the outside, using a motor driven thin abrasive cutting wheel, made a cut through the brick for the exact size of the sleeve. With an electric hammer he then knocked the brick into the room. The sleeve was set in place and caulked.

Next, the chassis was put in the sleeve and the electrical and steam connections made. Finally, the unit front panel, made to exact dimensions, was installed.

It was found that a complete installation could be made between 9 a.m. and 5 p.m., so that there was no loss of revenue. In the four months from March to June 1956 a total of 450 units was installed.

How Units Operate

Since the heating element inside the cooling unit was larger than the original convector, the air flow from the fan across this heating coil required operation only at low speed (800 rpm) for heating. On cooling, the fan operation is at 1050 rpm. A two-speed switch is reached through an access door and is set seasonally by hotel employees.

To provide automatic temperature control, a self contained thermostat with a remote bulb in the air stream on each unit controls both heating and cooling operations. A summer-winter switch inside the cooling unit is set on the winter position about December 1, so that the compressor will not run. It is set back in the spring to allow full operation.

To prevent operation of the fan should there be no steam in the heating element — as may be the case if the main zone valve is off for any length of time — a fixed setting type of thermostat is wired into the heating circuit, but is out of the circuit during the summer.

Two throwaway filters are in these units: one for outside air, the other for recirculated or return air.

It has been found necessary to replace these filters once a month in summer and every two months in winter. They are easily accessible and the work is scheduled so that it is done continuously by the hotel's heating men. The cost of these filters comes to about $900 per year.

The outside air dampers incorporated in the units are set manually by hotel employees. These open to outside air in summer but are kept closed in winter. If a guest requests extra ventilation in winter, the maids and bell boys are allowed to open the dampers.

System Pays Off

At the start of this program the cost of these units installed came to about $800 each, but with experience and practice the cost dropped to $725 and the superintendent hopes that he may finally get down as low as $600. At that rate the total cost of all units would be about half the cost of a central plant installed in such a large existing building.

The hotel employs a crew of six men, called the temperature men, whose primary duty it is to take care of the operation and normal maintenance of all heating, ventilating, and air conditioning equipment.

Joseph K. Blum was the consulting engineer for the heating control system. The air conditioning system was designed by Seelye Stevenson Value & Knecht. The air conditioning units were installed by Edward B. Kearney, Inc. ⧺

Photos courtesy American Radiator & Standard Sanitary Corp.

Seek Solution to Problem of Ductility in Steam Piping

. . . *containing welded joints at 1200 F*

BY R. W. EMERSON
Chief Metallurgist and Director

R. W. JACKSON
Research Engineer

Pittsburgh Piping & Equipment Co.

WHAT causes many of the failures in Type 347 austenitic stainless steel piping adjacent to welded joints at high temperatures? What other materials might prove more suitable for main steam piping service at 1050 F and above?

Answers to these questions were sought in laboratory tests of the plastic ductility of austenitic piping containing welded joints at 1200 F. This investigation of the capacity to withstand plastic strain without fracture had four main objectives:

1) To determine if low ductility failures could be induced in Type 347 heavy wall welded tubular joints under simulated service testing.

2) To study the effect of base metal grain size on the fracture ductility as measured by specimen elongation.

3) To establish, if possible, a metallurgical treatment which would improve the hot plastic ductility across the welded joint such that it would be more receptive toward the acceptance of additional plastic strain without failure.

4) To determine and compare the behavior of Type 316 with that of Type 347 under similar testing conditions.

Findings are summarized here:

1) Weld-heat-affected-zone service failures in Type 347 piping which occur at the outside diameter and progress toward the inside diameter were duplicated by simulated high temperature service testing of welded tubular specimens.

2) Increasing the solution treating temperature, and therefore the grain size of both Types 347 and 316, resulted in a general decrease of the room temperature tensile strength, yield strength and Brinell hardness, and an increase in percent elongation and percent reduction of area.

3) Room temperature ductility decreased in Type 347 when heated to 2300 F as compared to 2100 F. Since this loss in ductility was not observed in Type 316 material, Type 347 may be more susceptible to structural damage than Type 316 when subjected to high temperatures, including those from welding.

4) A slight increase in the room temperature yield strength was noted in Type 316 when solution treated at 2100 F as compared with 1900 and 2300 F.

5) The 1200 F yield strength of Type 347 tubular specimens containing as-welded joints was found to be lowered as the solution treating temperature was increased.

6) The 1200 F yield strength of Type 347 tubular specimens containing welds which were post weld heat treated at 1900 F was found to be 5000-8000 psi lower than the as-welded specimens.

7) The plastic ductility of as-welded tubular Type 347 specimens was found to be less than 0.1 in. in 20 in., with ductility decreasing as the base metal grain size increased.

8) The plastic ductility of welded Type 347 tubular specimens given a 1900 F post weld heat treatment was found to be at a level of 0.20 in. in 20 in., or double that of the as-welded specimens.

9) The 1200 F yield strength of as-welded tubular Type 316 specimens was found to be considerably lower than the values observed for Type 347, the shape of the curve as a function of base metal heat treatment, following closely that obtained on specimens tested at room temperature.

10) The 1200 F yield strength of Type 316 tubular specimens containing welds which were post weld heat treated at 1900 F was found, as in the case of Type 347 specimens, to be lower than the as-welded specimens.

11) The plastic ductility of welded Type 316 tubular specimens given a post weld heat treatment of 1900 F was found to be slightly greater than that for corresponding specimens in the as-welded condition. The as-welded Type 316 specimens, however, were found to exhibit 1200 F ductility at least equal to that obtained in Type 347 specimens given a post weld heat treatment.

12) Tack welds and arc strikes giving rise to microfissuring — metallurgical notches — as well as sharp changes in cross sections, such as short radius fillets, undercut, improper blending of heavy cover passes into the adjacent base metal — mechanical notches — giving rise

This article is adapted from a research report presented at a recent national meeting of the American Welding Society.

to stress concentration, may readily lead to premature stress rupture failures in austenitic materials and particularly in the Type 347 analysis.

13) Tubular specimens of both Types 347 and 316 were welded with Croloy 16-8-2 and tested in the as-welded condition. The plastic ductility obtained using Type 316 base metal was found to exceed 0.20 in. in 20 in. and based on these tests, therefore, indicated satisfactory performance. Duplicate tests made using Type 347 base metal, however, resulted in failure from the ID toward the OD along the line of fusion. Although the results were totally unexpected, it is believed that the results warrant additional study.

14) Base metal fissuring adjacent to welds was found in both Types 347 and 316 prior to high temperature testing. Results of these tests indicate that the grain boundary liquation theory is applicable. The results indicate that Type 347 is much more sensitive to fissuring in the temperature range of 2300-2450 F than is Type 316 material.

15) Standard guided bend tests removed from both Types 347 and 316 tubular specimens after high temperature testing were found to have adequate room temperature ductility.

16) A mechanism of failure is presented which is based on the summation of all stresses acting upon a given area at a given temperature for a given time. For a given operating temperature, stress rupture failures will occur with decreasing time as a function of increased stress applied. Localized areas of high stress — regardless of the origin of the stress — will fail prematurely, if the material has no capacity to absorb this stress by plastic deformation. ⫩

Freezing in Towers, Condensers Poses Serious Problem

. . . during winter operation

WINTER OPERATION of cooling towers and evaporative condensers poses serious problems of freezing and ice formation, warns Dr. Sidney Sussman, chief chemist, Water Service Laboratories, Inc., who suggests a number of techniques for avoiding these troubles.

He points out that winter operation of this type of equipment is increasing rapidly because of its wider use in air conditioning systems, the intermittent operation of such systems even during cold weather, and the year 'round use of air conditioning for special locations such as electronic computer rooms.

In general, ice formation during winter operation may be prevented, controlled, or removed by varying the method of operation of the cooling tower or evaporative condenser. In many cases this must be done merely to prevent the circulating water from getting too cold. Dr. Sussman suggests three operational schemes for winter operation:

1) Normal circulation with both sprays and fan in operation
2) Sprays on but fan off
3) Neither sprays nor fan operating. Water flow is bypassed through the pan of the tower.

Some installations make use of all three of the above procedures at different times. Or, the procedures are modified by using the cooling water temperature to control a thermostatic valve which varies the amounts of the circulating water going to the sprays and to the pan.

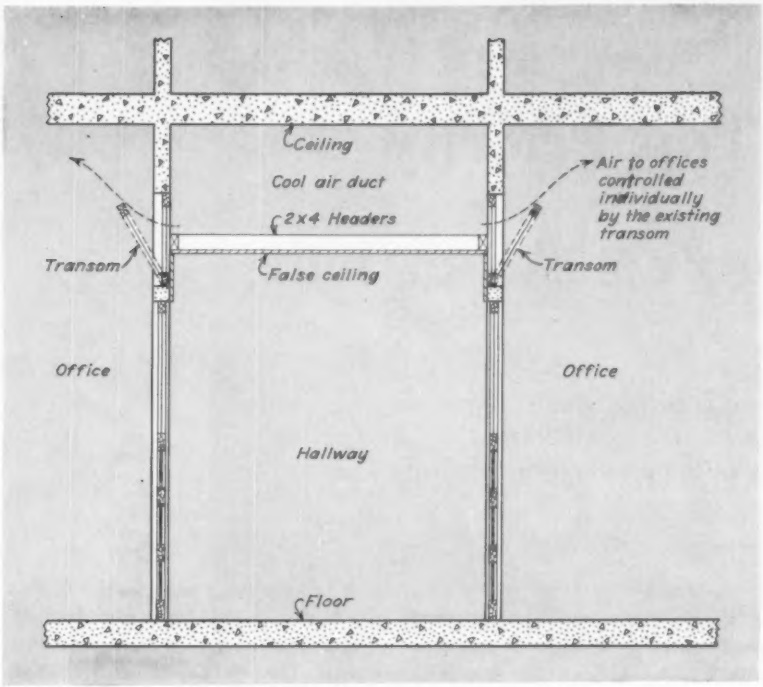
The prevention of freezing in exposed circulating water lines when the cooling tower or evaporative condenser is not being operated can best be done by mechanical methods.

One technique described by the chemist is to use a sump or a surge tank indoors. The equipment is arranged so that every time it is shut down or every time the water temperature falls below a specified minimum, say 35 F, the contents of the outside portions of the system drain into the surge tank. In most such installations, during winter operation the cooling tower pan or evaporative condenser does not contain the same depth of water as during summer operation. Instead, the pan drains completely as soon as the circulating water flow is shut off.

A second technique for protection of exposed water lines from freezing is to wind about them thin copper steam tubing or electrical resistance wire, and to cover this with insulation. The lines can then be heated by steam or electricity, controlling the application of the heat with a thermostatically controlled switch or valve located at the coolest spot in the system. Such installations are generally set to start the heat when the water reaches about 35 F and to shut it off when the water gets to about 40 F.

It is usually not necessary to protect the cooling tower pan since the formation of ice in it will cause no damage, although in some cases the pan is also heated by the same method in order to insure against freezing completely and thereby interfering with water flow when the equipment is to be operated.

When air conditioning requires the use of cooling towers or evaporative condensers during winter weather, ice formation and freezing damage can be minimized by simple changes in the method of operation, Dr. Sussman says. When it appears that winter use will be necessary, the operation of the cooling system should be analyzed well before freezing weather sets in, in order to allow time for making any necessary mechanical changes. ⫩



FALSE CEILING installed beneath existing ceiling forms hallway duct which conveys cooled air to offices through existing transoms. Evaporative cooling unit is installed on platform against outside wall at rear of building

Corridor Duct Supplies Evaporatively Cooled Air Through Office Transoms

. . . in old building

EVAPORATIVELY COOLED AIR is distributed through a furred-in ceiling space to the offices of the Combined Metals Reduction Co. on the second floor of the Felt Bldg. in Salt Lake City.

In planning this system, it was decided to put the building's existing high ceilings to some practical use. There was 11 ft of headroom along the hallway. To utilize the excess space, carpenters secured a row of 2 × 4 in. headers from wall to wall across the 7 ft wide hall 3 ft below the existing ceiling. Then they faced the headers with pressed wood panels. This formed a false ceiling, which in turn formed a duct 7 ft wide by 3 ft deep and 100 ft along the length of the hall.

In conjunction with the construction of the duct, the crew erected a platform snug against the outside wall at the rear of the building along the hallway window. Then an evaporative cooling unit was mounted on and secured to the platform.

A water pipe line was connected to the unit and a sheet metal duct connected the hallway duct.

An occupant of any office in the 18 room suite now has independent temperature control. He regulates the room to his satisfaction simply by opening his transom to the width necessary to admit the desired volume of cooled air being admitted through the duct.

The duct comes to a dead end at the far end of the hall. This enables the fan, moving 12,000 cfm of air, to build up and maintain a slight but constant pressure inside. Personnel working in the different offices report no noticeable temperature variation once their own transom is opened to the desired width, regardless of how many other transoms may be later opened, closed, or further adjusted. During summer months when outside temperatures of 100 F prevail, the average temperatures inside the building range as desired from about 75 to 80 F. This 25 F drop is achieved in about 1 hr from the time the fan is turned on.

In wintertime, the cooling unit can be shut off and the fan and duct system may be used for forced air ventilation.

Upkeep and repair problems in the installation are virtually nonexistent.

Ducts of the same type have since been constructed on the first and basement floors of the building and connected to a warm air furnace to provide heating.

The evaporative cooling unit as installed can be expected to operate most effectively in arid climates. Humidity control in Salt Lake City has been no problem. A small, built-in pump meters water into the evaporative cooler. The amount of water can be varied if desired, but so far no one has felt the need for readjusting the pump from its original setting, regardless of the weather.

For satisfactory operation of a similar system in humid areas where moisture content of the air is continually near the saturation point, a conventional refrigeration unit at the head of the duct may be installed to provide the cooling effect.

The air conditioning engineer and contractor was the Jensen Construction Co. ≠

Safety Takes Top Priority In Heating, Cooling Atom Lab

Radiological research work requires that each floor be heated, air conditioned by its own system—using 100 percent outdoor air.

BY W. O. MILLER
Heating and Air Conditioning Engineer
Rosener Engineering, Inc.
Engineers and Architects

DESIGNING a heating and air conditioning system to meet the safety requirements of an atomic laboratory is no mean task. Such was the case with the U.S. Naval Radiological Defense Laboratory in San Francisco, which is seeking ways to protect installations and civilians from the dangers of radiation in an atomic attack.

From 128 finished drawings has emanated a system versatile enough to provide heating and air conditioning for office and laboratory spaces, a large area for the maintenance of animals, a machine shop, an auditorium, and a large cafeteria.

The windowless, six-story, concrete building measures 415 ft long, 109 ft wide, and 96 ft high from the first floor level to the cafeteria floor level. The windowless feature, incorporated primarily to provide maximum wall area for laboratory benches, also provides a degree of blast protection to personnel and equipment in case of explosion or like hazards.

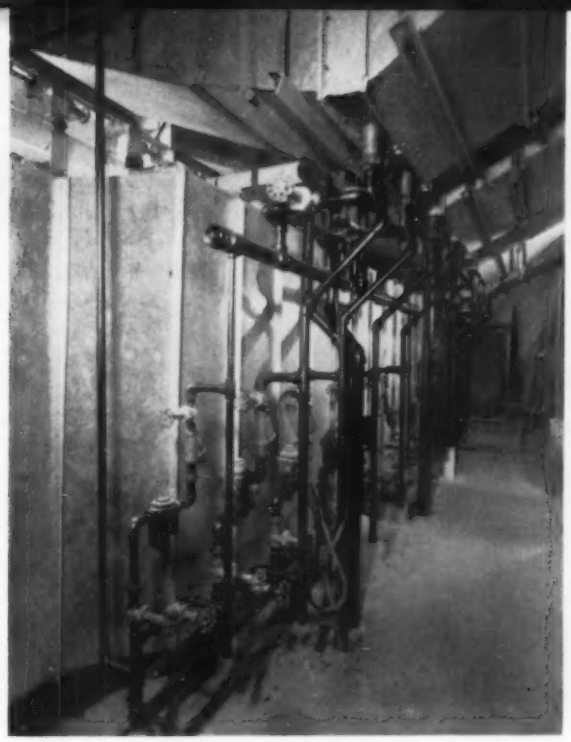
CONCRETE, WINDOWLESS LAB, devoted to study of protection from radiation in atomic attack, has ventilation requirements ranging 50 to 14,000 cfm for 490 different sized rooms

Official U.S. Navy photograph

Approximately 15 percent of the building area is taken up by corridors, escalators, elevators, stairwells, and mechanical equipment rooms. The remainder is used for offices, laboratories, shops, an auditorium, animal rooms, a cafeteria, and other purposes. This space is partitioned into about 490 different sized rooms, with individual ventilation requirements varying from 50 to 14,000 cfm.

With safety requirements a high level need, much equipment of this nature has been provided, including emergency lighting systems, special showers for personnel working in laboratory areas, special filters for air from laboratory areas, automatic fire dampers and extinguishers, automatic alarms, and other equipment or apparatus needed to afford maximum protection, not only for the occupants, but for the building and its equipment as well.

Outdoor air is delivered to the building at the rate of 482,000 cfm. All but 17,000 cfm is adequately filtered, heated, and/or cooled as



ALL AIR delivered to 490 different rooms and to corridors is first passed through tempering coils, then through reheat coils. Shown here are piping, ductwork where this is accomplished

Official U.S. Navy photograph

required before being delivered to the 490 rooms or areas.

This quantity of air is much greater than normally required for the average building of equal volume. This quantity is needed since the structure contains a great many laboratory hoods that require an average of 1000 cfm each. Some rooms contain only one hood, while others may have two, three, or perhaps more. Therefore, it is the number of hoods, at 1000 cfm each, that create the large demand for air. This is a 100 percent outdoor air job.

The air is supplied to all areas through low velocity air duct systems, with adjustable type ceiling diffusers. The largest duct measures 115 in. wide × 36 in. deep.

Air distribution is direct to all corridors and direct to some rooms, and from corridors to some rooms, and a combination of direct to and from corridors to some rooms. In other words, all air supplied to corridors is used either wholly or in part by some of the rooms.

This method is another safety feature in that all corridors have a plus pressure in relation to the rooms so that the air in any room cannot escape into the corridor. Laboratory rooms are given added consideration toward keeping them negative with respect to the corridor on which they face.

Balanced Air Needs Critical

This matter of air distribution became quite a design problem. There are, other than the corridors, 190 rooms with all direct supply air and 200 rooms that are supplied from the corridors only. The remaining 100 rooms are supplied partly by direct supply and partly by corridor air.

The exhaust air duct systems had to be carefully balanced in relation to the supply systems to maintain the proper pressure difference so that corridor air would always flow into the rooms through louvers in the doors. In a few instances additional wall louvers were added to supplement an insufficient door louver net area.

This method of air distribution made it necessary to supply air to corridors in quantities greater than normally required. Careful design analysis did, however, keep it to the very minimum, thereby avoiding undue air movement in the corridors so that highly satisfactory results are achieved.

Air noise levels in areas that require exceptionally large quantities of air are obviously higher than other areas where air quantities are in line with normal requirements for heating and ventilating.

Maintain Mean Temperature

The heating of all air delivered to the rooms is first passed through tempering coils and then through reheat coils. The reheat coils are controlled by thermostats located in the corridors.

Except for 11 rooms with special requirements, there is no individual room temperature control. The rooms are supplied with air whose temperature has been evaluated at six different locations in the corridor of each floor and then averaged to maintain a satisfactory mean air delivery temperature.

This became a problem where the laboratory rooms with hoods were involved, since there were many cases where a room without hoods required, for example, only 500 cfm of air and an adjacent room of equal area and with two hoods required

STEAM for heating, other purposes enters building at 125 psig through underground piping connected to main steam system serving San Francisco Naval Shipyard. Steam for space heating is reduced to 5 psig. Shown are steam and condensate lines, other piping in basement

Official U.S. Navy photograph

2000 cfm. This problem was met by raising the mean average temperature in the corridors involved.

Remote Steam Supply Source

Steam for heating and other purposes is brought into the building at an average pressure of 125 psig through underground piping that connects with the main steam system serving the San Francisco Naval Shipyard. The maximum demand for this building is estimated to be 38,500 lb per hr of steam of which 27,000 lb per hr is available for space heating requirements.

The steam for space heating is reduced to 5 psig. There are other 5 psig steam requirements and a few others for steam at 80 and at 50 psig. All recoverable condensate is pumped back to the steam generating plant through a system of condensate return piping.

Serve Special Cooling Needs

Cooling of all air delivered to the rooms is accomplished by refrigerant No. 12 equipment. There are about 11 rooms that are air conditioned to the extent that they are required to have temperature and humidity conditions maintained at fixed values. In these rooms a wide range of temperature and humidity conditions is required for testing and/or research at some predetermined condition within the practical range of equipment limitations.

All other rooms or areas are under temperature control only and, like the heating system, do not have individual room control. The one exception is the isotope storage room which has its own cooling and heating system located in its own small machinery room. Year 'round temperature control only was established as a design requirement and was so provided. Humidity control was not considered necessary and was not provided, but use has indicated that it may be necessary to provide it in laboratory areas. The possibility of furnishing humidity control throughout the building is also under consideration.

Temperature control for cooling, as for heating, is accomplished through evaluating the temperature of the corridor air at six locations on each floor and averaging it.

The load requirements for all rooms that are under a maintained temperature and/or humidity are met by equipment that will provide about 30 tons of refrigeration. The other areas are supplied by equipment that will provide about 708 tons.

This value requires some qualification in that it was never intended that a fixed temperature be maintained throughout the entire summer season. It was reasoned that if the system maintained an average inside temperature of 80 F when the outside air temperature was 90 F occupants would be fairly comfortable. Actually, 90 F for the San Francisco area occurs only a few days out of the year. Since this installation is a 100 percent outdoor air job, a rapid rise of air conditioning tonnage requirements develops as the outside air temperature and humidity rise. This requirement is without any consideration of the internal heat load of the building. The tonnage installed is a compromise based on a careful evaluation of cost, weather, and other available data.

Controls Not Localized

The temperature and humidity control systems for all requirements are of the pneumatic type. They include all the necessary thermostats, humidistats, damper motors, valve

motors, accumulators, flow control devices, thermometers, pressure gages, averaging bulbs, interlocks, and other accessory devices.

Since each floor of the building and each system on each floor was required to be isolated and operated as an independent unit, it was found too costly and impractical to install a central type control panel. A central fan control panel is provided in the security office adjacent to the lobby, however. This panel permits manual control when required, such as for operation of exhaust fans only on the emergency power circuit.

All the control apparatus is easily accessible to trained personnel either available on the premises or those maintained in San Francisco by the equipment vendor for installation or service requirements. The greatest possible simplicity is manifest in the control system and, as a result, adjustment and/or servicing has been relatively easy and infrequent.

Filter Exhaust Air

The requirements for filtering of air are rigid — in particular, the air exhausted from the building. All exhaust hoods in laboratories are equipped with filters of the type required to meet each hood's special requirements. The isotope storage room air system is also equipped with special type filters for the same reason.

The air supply filters, on the other hand, are high efficiency, viscous medium, permanent, washable type that measure about 20 × 20 in. square. The filtering medium is fireproof and moisture resistant.

Two Buildings in One

Actually, the structure is two buildings in one that are joined end to end with a concrete partitioning wall with free access between them through in-line corridors. Doors in the corridors make it possible to isolate one building from the other when desired or required. While there is continuous interbuilding transit of personnel, each building is a separate unit and, from a heating and air conditioning standpoint, each floor of each building or increment is also separate from the other.

Every floor of each building or increment has its own heating, cooling, and ventilating system with a separate machinery room for each system.

The two buildings, as such, are identified as increment No. 1 and increment No. 2. The heating and air conditioning equipment is apportioned according to schedules for each of these increments. These schedules are listed in Table 1.

Increment No. 1 comprises 309 ft of the total 415 ft of overall length, 352,000 cfm of the 482,000 cfm total air handled, 27,000 lb per hr of the 38,500 lb per hr total steam required, 545 tons of cooling of the 738 tons total required, and 380 rooms of the 490 total rooms that are heated, cooled or completely air conditioned. Increment No. 1, being the larger, contains the main entrance and all the escalators.

This does not, however, minimize the importance of increment No. 2. On a per square foot of floor area basis they are on a par. On that basis size difference becomes irrelevant.

There exists as a part of this laboratory facility another entirely separate, much smaller building known as the high voltage accelerator building in which is located a van de Graaff generator used in connection with the work done in the large building. That building is also equipped with two separate air conditioning systems; one for the generator room and one for the few offices and one small laboratory room in the building.

The facility is an important part of the overall picture. But relatively, the air conditioning is comparatively small and, therefore, not included as a part of the narrative covering increments Nos. 1 and 2 of the large laboratory building as a whole. ∓

The opinions, observations, and conclusions contained in this article are those of the writer and not necessarily those of the Navy Dept.

TABLE 1—HEATING AND AIR CONDITIONING EQUIPMENT schedules for building increments Nos. 1 and 2 are listed here

Increment No. 1

Quantity	Type of equipment	Location in building
14	Air supply fans	2 on each of 6 floor levels located in machinery rooms at each level
20	Exhaust fans	18 on roof and 2 in basement machinery room
50	Tempering coils	In machinery rooms on 6 floor levels
50	Reheat coils	In machinery rooms on 6 floor levels
52	Refrigerant No. 12 double row coils	In machinery rooms on 6 floor levels
15	Refrigerant No. 12 compressors with condensers	In machinery rooms on 6 floor levels
2	Cooling towers	On roof
3	Condensing water pumps	In basement machinery room
1	Condensate pump and receiver	In basement machinery room
11	Room air conditioners without compressors	In separate rooms

Increment No. 2

Quantity	Type of equipment	Location in building
13	Air supply package type units with heating and double row coils	In machinery rooms on 6 floor levels
8	Exhaust fans	On roof
24	Tempering coils	In machinery rooms on 6 floor levels
7	Refrigerant No. 12 compressors with condensers	In machinery rooms on 6 floor levels
2	Condensing water pumps	In basement machinery room
1	Condensate pump and receiver	In basement machinery room
1	Cooling tower	On roof

Note: Filters and temperature control equipment are not enumerated. Obviously, there are many of both.

The Law and Your Profits

BY WILLIAM HURD HILLYER

Contractor's Bookkeeping Shortcut Proves Expensive Proposition

SHORTCUTS in bookkeeping are poor business practice. Especially so are those involving failure to enter all cash payments. While the following case was won by the heating, piping, and air conditioning contractor, it contains a moral for bookkeeping methods, particularly when government subsidies are involved.

E. Z. Winsum performed heating, piping, and air conditioning work amounting to $130,000 for the Ark Hotel, under general contractor Overall. By agreement, Overall was to settle monthly with Winsum for all monies due.

Overall and the hotel secured advances from the Reconstruction Finance Corp. based upon expenditures, which included the payments to Winsum. Monthly statements were submitted by him and were carefully checked by the general contractor. Adjustments were frequently made at that contractor's request.

Overall fell behind in his payments to Winsum. Eventually, Winsum submitted a complete account showing a balance due him of approximately $12,000. In order to foreclose a lien for this balance, Winsum sued the Ark Hotel and obtained a full judgment.

Appealing to the state supreme court, the hotel contended that the lower court improperly charged it with the cost of repairs and replacement of certain parts, which were alleged to have been defective. In maintaining that it should not have been so charged, the hotel relied upon the general principle that a contractor, under a cost-plus agreement, is not entitled to charge for the cost of doing work over — even though that work had been caused by defective parts.

The supreme court pointed out that the lower court had apparently concluded that most of such extra work had been necessitated either by Overall's own negligence or by that of the electrical contractor in failing to properly hook up an electrical oil safety switch. This neglect was shown to have resulted in ruining parts of Winsum's installation.

The hotel further contended to the supreme court that it was never credited for a payment of $7191.00, which it had made by check, and that Winsum had failed to properly credit the hotel with $60.00 of the replacement amount, allowed by the manufacturer.

According to Winsum under cross examination, Overall "paid cash . . . at that time for a truckload of pipe that had been delivered during the month." This was done so as to "get the receipted bills to submit to the government . . . and my bookkeeper handled it as a cash item, because it had never been posted."

In response to a question, Winsum testified that the transaction was not entered on the books at any time as part of the contract.

The supreme court conceded that the factual issues "were determined by the lower court on testimony that is to some extent conflicting." Nevertheless, the judges were unable to say that the lower court's findings were against the preponderance of evidence.

Judgment was therefore affirmed in favor of Winsum for the amount of his claim, less the $60.00 not accounted for.

Winsum might have foregone the supreme court trial had he not withheld the cash item from his books. The lower court, in the opinion of the supreme court, probably considered it significant that Winsum accepted monthly statements over a period of four years, without indication that proper credit had not been given to him.

The court pointed out that, although the general contractor appeared to have in his possession at the trial all the hotel's checks and the various vouchers issued in connection with the project, he offered no tangible evidence to contradict the hotel's explanation of the check for $7191.00, nor did he deny delivery of the pipe as indicated by the hotel. ∓

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. All names are fictitious. It should be remembered that laws vary in different states.

How to Find Pressure Drop, Select Best Pipe Size

. . . *for compressed air piping*

BY J. F. WATERS
Assistant Design Engineer
Ewbank & Partners, Ltd.
Consulting Engineers

Good compressed air practice demands that the pressure drop between the receiver and the power tool to which it is connected does not exceed 10 percent of receiver gage pressure. Sizing pipe for these lines or choosing a pressure drop for a selected drop for a selected pipe size may be accomplished using the following equation:

$$Pd = [0.1025\ (q)^2\ L]/[rd^{5.31}]\ \text{psi} \quad \ldots\ldots\ldots[1]$$

where:

Pd = pressure drop, psi
q = flow rate of *free* air, cfs
L = pipe length (or, more usually, equivalent pipe length, i.e., pipe and fittings), ft
r = ratio of compression at pipe entrance
d = pipe inside diameter, in.

This equation is valid for pressure drops not exceeding 10 percent of pipe entrance absolute pressure.

The ratio of compression at the pipe entrance is the pipe entrance absolute pressure divided by 14.7 psia. Hence:

$$r = P_1 + 14.7/14.7$$

where:

P_1 = pipe entrance gage pressure.

Using Q instead of q, and P_1 instead of r, we get:

$$Pd = [0.1025\ (Q^2/3600)\ L]/[(P_1 + 14.7)/(14.7)d^{5.31}]\ \text{psi} \quad \ldots\ldots\ldots[1a]$$

Free air is air at 14.7 psia and 68 F at a given volume. If we know only the volume of air at *as compressed* pressure and temperature, we can calculate the free air using the formula:

$$P_a V_a/T_a = P_b V_b/T_b$$

This can be transformed into:

$$Q = [528\ V_1\ (P_1 + 14.7)]/[14.7\ (T_1 + 460)]\ \text{cu ft of free air} \quad \ldots\ldots\ldots[2]$$

where:

Q = equivalent volume of free air
V_1 = actual volume of *as compressed* air, cu ft
P_1 = actual pressure of *as compressed* air, psig
T_1 = temperature of *as compressed* air, F

This equation is accurate for commercially dry air, i.e., air which has passed through an aftercooler at the compressor location.

Reverting to Equation 1a we see that pressure drop varies directly as L and $Q^2/3600$, and inversely as $d^{5.31}$. Thus, the most important single factor is the pipe size. This is illustrated by the fact that halving the pipe size increases the pressure drop by more than 30 times.

How to Use Chart

Equation 1a has been adopted by the Compressed Air and Gas Institute as a standard formula for computing pressure drops. The chart on the next page has been prepared using this equation as a basis. Here's how to use it:

Feed the values of P_1, Q and L applicable to a particular pipe into the chart via vertical line C_1, to give point of intersection on the vertical line C_2 as shown in the example. Now a pressure drop can be determined for a planned pipe size or correct pipe size for an allowable pressure drop, by using a straight edge up or down to d'' and Pd scales while using the intersection point on C_2 as a pivot. Always remember that Pd must not exceed 10 percent of $(P_1 + 14.7)$ psia.

If the volume of free air is not known — only P_1, V_1, and T_1 — use either Equation 2 or the chart for converting compressed air into free air.

To find the equivalent pipe length if the proposed installation includes various fittings, refer to manufacturers' literature regarding equivalent lengths of such items.

Consider two examples to illustrate the use of the chart.

Example 1

A 1¼ in. Schedule 40 steel pipe, 40 ft long, carries 250 cfm of free air from a receiver with air at 100 psig to a power tool. What is the pressure drop between receiver and tool?

Using a straight edge, connect 100 psig on the P_1 scale to 250 cfm on the Q scale. Project to intersect vertical line C_1. Connect the intersection point on C_1 to 40 ft on the L scale and project again to intersect the vertical line C_2. Connect the intersec-

Tear out along this line
HPAC DATA SHEET

tion point on C_2 to the 1¼ in. Schedule 40 pipe graduation on the d'' scale and project, finally, to intersect the pressure drop scale Pd at 1.62 psi, the pressure drop between receiver and tool.

Example 2

For Example 1 it is required to limit pressure drop between receiver and tool to 0.4 psi. What is the best pipe size to use?

Proceed as in Example 1 and obtain the intersection on C_2. Connect this intersection point to 0.4 psi on the Pd scale and read pipe size on the d'' scale. In this case d'' lies between 1½ and 2 in. and, therefore, use should be made of a 2 in. pipe.

For values of Q greater than 1000 or less than 12.5, the chart can be used provided that the pressure drop is proportional to Q^2 and that the solution obtained by using some other value of Q be multiplied by the ratio:

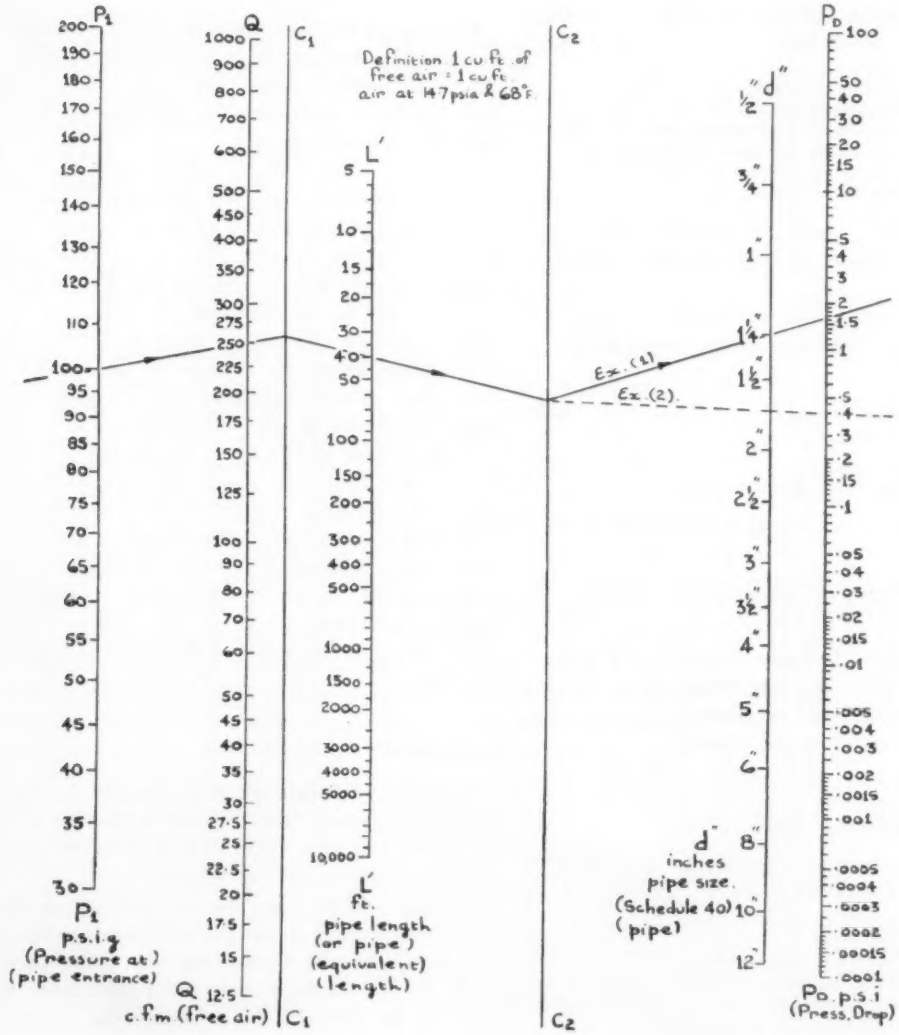
$(Q/\text{actual value used on } Q \text{ scale})^2$.

For example, if Q in Example 1 had been 2500 instead of 250, 250 on the Q scale could be used and multiplied by the pressure drop obtained by $(2500/250)^2 = 100$, giving a true pressure drop for 2500 of 162 psi. (As this exceeds the receiver pressure by much more than 10 percent, a 1¼ in. pipe should not be used and a larger size tried.)

Similarly, if when feeding values of Q and L into the chart it is found that C_1 or C_2 cannot be intersected, Q or L can be reduced or increased to some convenient multiple. Then divide or multiply the value of Pd obtained by the appropriate ratio for Q, or (L/length used), as the case may be.

As an alternative to employing a ratio factor, in some cases it may be possible to obtain results by extending the vertical lines C_1 and C_2 from the extreme top to the extreme bottom of the chart by adding lines.

For the free air consumption of equipment, reference should be made to data available from manufacturers. ⌗



NOMOGRAM based on standard formula provides shortcut to finding pressure drop or best pipe size for compressed air piping. How to use it is described on preceding page

HEATING, PIPING & AIR CONDITIONING

JOURNAL SECTION

OF

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

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President's Message

ASHAE — A Membership Corporation

Our Society is a membership corporation which is chartered in the state of New York. As such it is a society of professional engineers engaged in a wide variety of activities dealing with the arts and science of air conditioning, heating and ventilation. I recently made the following analysis of the budget adopted by Council in October, 1957, for the fiscal year 1958 to study the sources of income and the magnitude of financial participation by the average member in these activities. Since the budget is balanced the income and expenditures are anticipated to be $706,995.00 for approximately 11,300 members.

Schedule		INCOME	Average Member
Dues & Admission Fees		$291,535	$25.80
Publications		223,500	19.80
Investments & Other Receipts		4,705	0.40
Contributions		99,440	8.80
General Fund		18,465	1.60
Research Reserve		48,190	4.30
Contractual Research		21,160	1.90
	TOTAL	$706,995	$62.60

Schedule		EXPENDITURES	Average Member
Meetings, Chapters & Committees		$ 42,150	$ 3.70
Publications		138,800	12.30
Headquarters		240,175	21.25
Research & Research Promotion		277,870	24.60
Admission Fees to Reserve		8,000	0.75
	TOTAL	$706,995	$62.60

Schedule		RESEARCH INCOME	Average Member
Members Dues		$107,010	$ 9.50
Investments		2,070	0.20
Contributions		99,440	8.80
Reserve from Exposition		48,190	4.25
Contractual		21,160	1.85
	TOTAL	$277,870	$24.60

1957 NET WORTH — $582,964 Average Member — $51.60

I found it interesting to note that the average member is participating in the Society's activities to the extent of $62.60, while contributing $25.80 directly thereto through dues and admission fees. All this has been accomplished with a dues structure that has remained fairly constant since 1925 at $25.00 per member except for an equivalent increase of $2.00 in 1955 when the Journal subscription was made optional. In Research the member contribution is about 39 percent of the total and 61 percent is obtained from Contributions, Exposition and Contractual. Another interesting item is that the Net Worth for the average member has grown to $51.60.

Attention is directed to the fact that it was necessary to transfer $18,465 from the General Fund to Income to provide a balanced budget.

As a membership corporation the Society is solely owned by you—the membership and you elect the Council to direct its operations for the purposes set forth in the Charter.

E. R. Queer

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Editorial Assistant

Information on other Society personnel can be found on page 146.

Design of High-Temperature Water Systems for Military Installations

By

C. A. Carter and B. L. Sturdevant

Mr. Carter is Special Assistant to Chief, Military Design Branch, Omaha District, U. S. Army Corps of Engineers, Omaha, Nebr., and Mr. Sturdevant is Head, Mechanical Engineering Department, Stanley Engineering Co., Muscatine, Ia. A presentation at the Symposium on High-Temperature Water at the 64th Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, Pittsburgh, Pa., January 28, 1958.

ALTHOUGH one does not subscribe to all of the claims at times made as to the advantages obtained through the use of high-temperature water systems, there are, for specific installations, certain application advantages which have demonstrated the worth of these systems. The first problem in design, therefore, is to establish the specific requirements of the installation under consideration and to determine that these requirements are compatible with the advantages to be obtained through the use of a high-temperature water system.

System Selection Factors

The first step is the determination of the amount, type, location and characteristics of the loads to be served. Amount of the load, load factor, peak demand and requirements for pressure and temperature will affect selection of the type of system and equipment. The location of the load may be one of the determining factors in selection of either a steam or high-temperature water system. For loads located near the plant or for more concentrated distribution systems the costs for a steam distribution system will be comparable to or less than those for a high-temperature water system of equivalent design. However, as the distribution lines extend away from the plant for greater distances the costs of steam distribution very soon become equal to high-temperature water, and as the size and length of the system expand, initial costs are increasingly in favor of high-temperature water.

The United States Air Force has adopted a policy of using high-temperature water for all new plants requiring a capacity over 30 million Btu per hour. This criterion is based on economic studies and observation of plant operation, and is in the area where plant sizes and costs should become competitive. However, it is only an approximation of the point of economic justification. Consequently, each installation should be studied for its individual requirements and the type of system selected only after adequate comparison and economic studies of the alternatives have been made.

First Cost Figures

Studies of costs of plants for a number of military installations have, in general, indicated the following.

First costs of high-temperature water central heating plants are usually greater than comparable steam plants. Similarly, the cost of equipment and piping for individual building utility rooms is higher for the high-temperature water installation. However, the size and location of the distribution system loads, as encountered, frequently change completely this initial cost picture when viewing the total installation cost.

Maintenance and Operating Costs

Maintenance costs normally favor the high-temperature water installations, since maintenance personnel costs are about equal and maintenance material costs are definitely lower for the high-temperature water installations.

Operating costs show considerable variation for different installations. Comparison of trap, venting and radiation losses depend to a large extent on the pressure and characteristics of the installation. Consequently, operating costs for a high-temperature water system may nearly equal, or be 15 to 20 percent lower than, those for a comparable steam system for a specific application.

Pressurizing Methods

Once load data are established and design criteria or economic analysis has dictated the use of a high-temperature water system, it is necessary to select the system pressurizing method to be used.

Since it appears to be the most economical, simplest and most readily adaptable method, most military installations within the United States have used steam in the expansion drum as the pressurizing medium. The most frequent criticisms of this method are with reference to the problems encountered in pumping a liquid at or close to its saturation pressure and temperature. A properly designed system, providing adequate NPSH (net positive suction head) for the pumps, will have no difficulty. The recirculation of cooler return water to the suction side of the pumps is only a poor solution to a problem resulting from inadequate design of the suction piping and insufficient attention to suction velocities, pressure drops and net positive suction head.

The alternate method of pressurizing by air or gas pressure will permit maintaining a wider margin above the

critical pressure. However, it also results in higher operating cost, especially so in the case of using an inert gas, such as nitrogen, to prevent corrosion.

Operating Pressures

In determining the operating pressure, consideration must be given to the highest pressure, or the highest temperature required by any heat consumer, since the minimum hot water temperature will be determined by that requirement. In addition, consideration must be given to the characteristics of the distribution system and the advantages that may result if a higher temperature and a greater temperature drop can be used. It is obvious that only half the amount of water need be circulated if a 200 F deg temperature drop can be used rather than 100 F. In order to take advantage of an increased temperature drop, it may be necessary to go to a higher boiler pressure. Therefore, the distribution economies to be gained by use of the greater temperature drop must be balanced against the increased central plant costs resulting from the use of a higher cost boiler. In general, most military installations have used boilers designed for 400 psig with systems

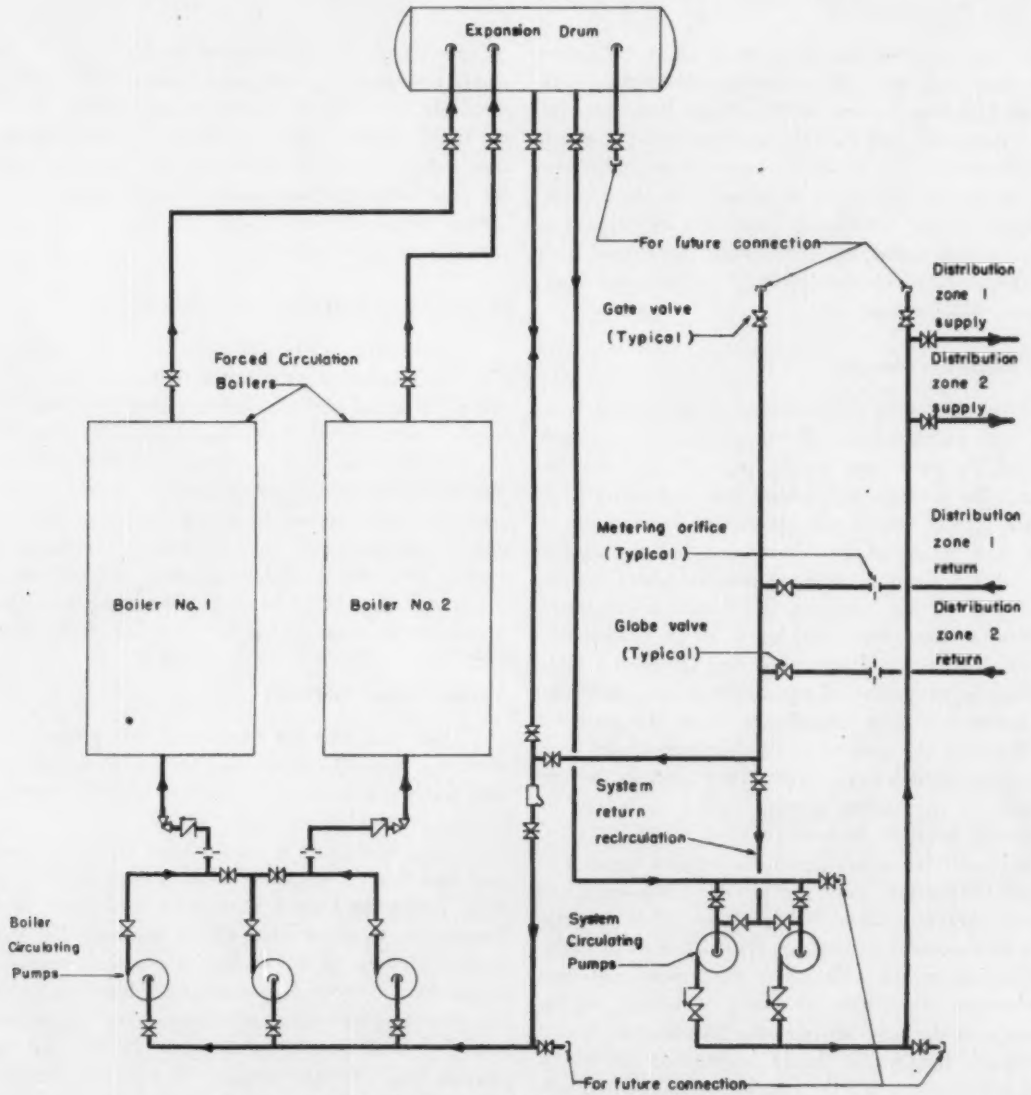

Fig. 1 — High-temperature water piping for separate pump system

of 300-lb design operating at 275 psig and 414 F. Use of this higher pressure, coupled with the distribution design for only about 100 F deg temperature drop, provides a good margin for the addition of future or unpredictable loads, which is highly desirable in military installations.

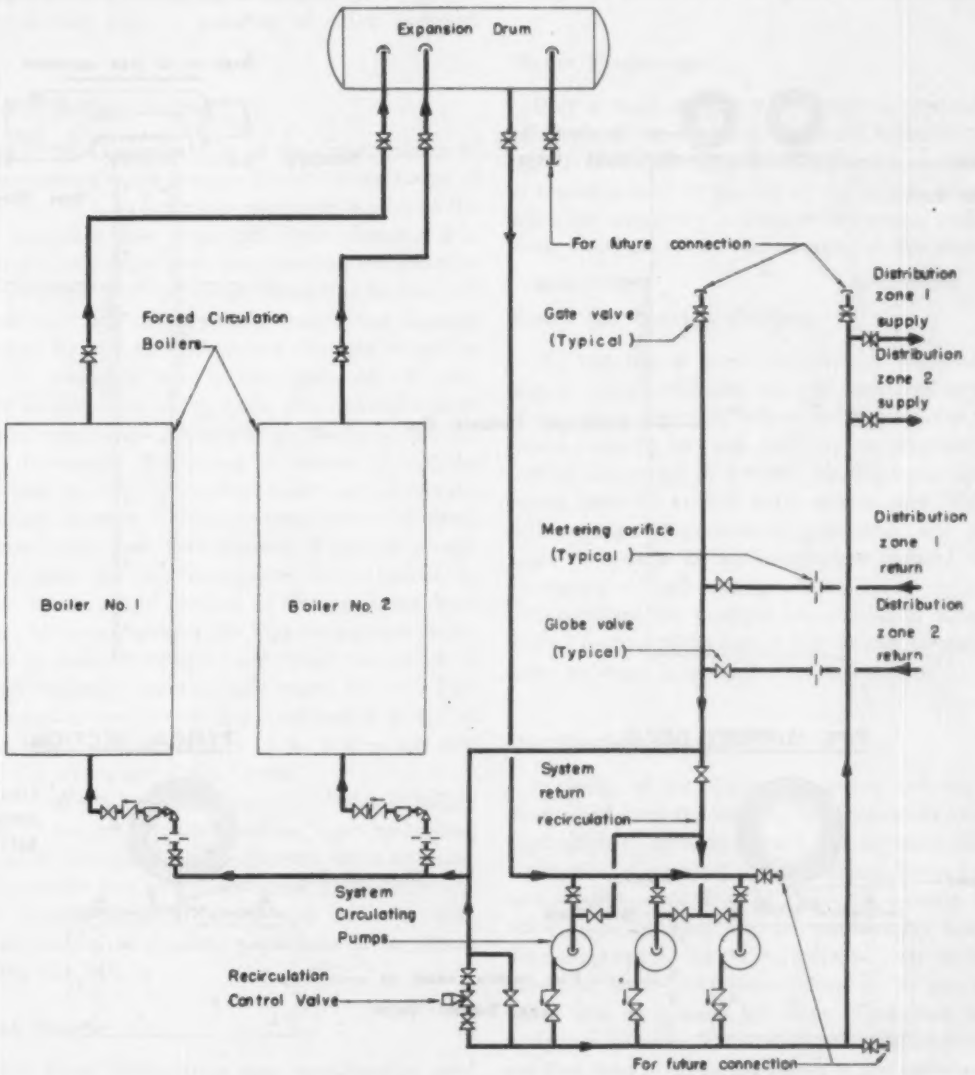

Fig. 2 — High-temperature water piping for combined pump system

Distribution Pumping

Pumping arrangements for distribution of the water through the boilers and system may be either the separate-pump system (Fig. 1) or the combined-pump system (Fig. 2). The combined-pump system uses only one pump, or pumps in parallel to provide for load variations, taking suction from the expansion drum and pumping water to and through the distribution system, returning the water through the boiler to the expansion drum. To maintain minimum required flow to the boiler, a bypass valve is installed at the discharge of the pumps to bypass water directly to the boiler inlet. This method should be used only with boilers having a comparatively low pumping head loss, since the greater the head loss within the plant itself, the smaller will be the head available for design of the distribution piping and the more costly will be the piping system. Pumps are selected in number and capacity to parallel the boiler installation, with one spare pump.

A margin of 10 to 20 per cent in pump capacity is added to each pump to provide for boiler recirculation and for future loss in capacity due to wear.

The separate-pump system uses separate system and boiler pumps, with one pump for each boiler taking suction from the expansion drum, circulating water through the boiler and returning it to the expansion drum, and with system pumps which take suction from the expansion drum and pump water to and through the distribution system only, returning it to the suction side of the boiler circulating pumps, or to the expansion drum. This method permits the use of either high or low pressure drop across the boilers. The boiler circulating pumps are selected with capacity paralleling the required flow through each boiler, with the system pumps designed to meet the head and capacity requirements of the system without regard to the required boiler flow. In investigations made of the 2 pumping systems it has become quite apparent that although the separate-pump system has the greater installed motor horsepower in pumping equipment, it will frequently operate as economically, or even more so, than the combined-pump system. This is especially true on systems having a

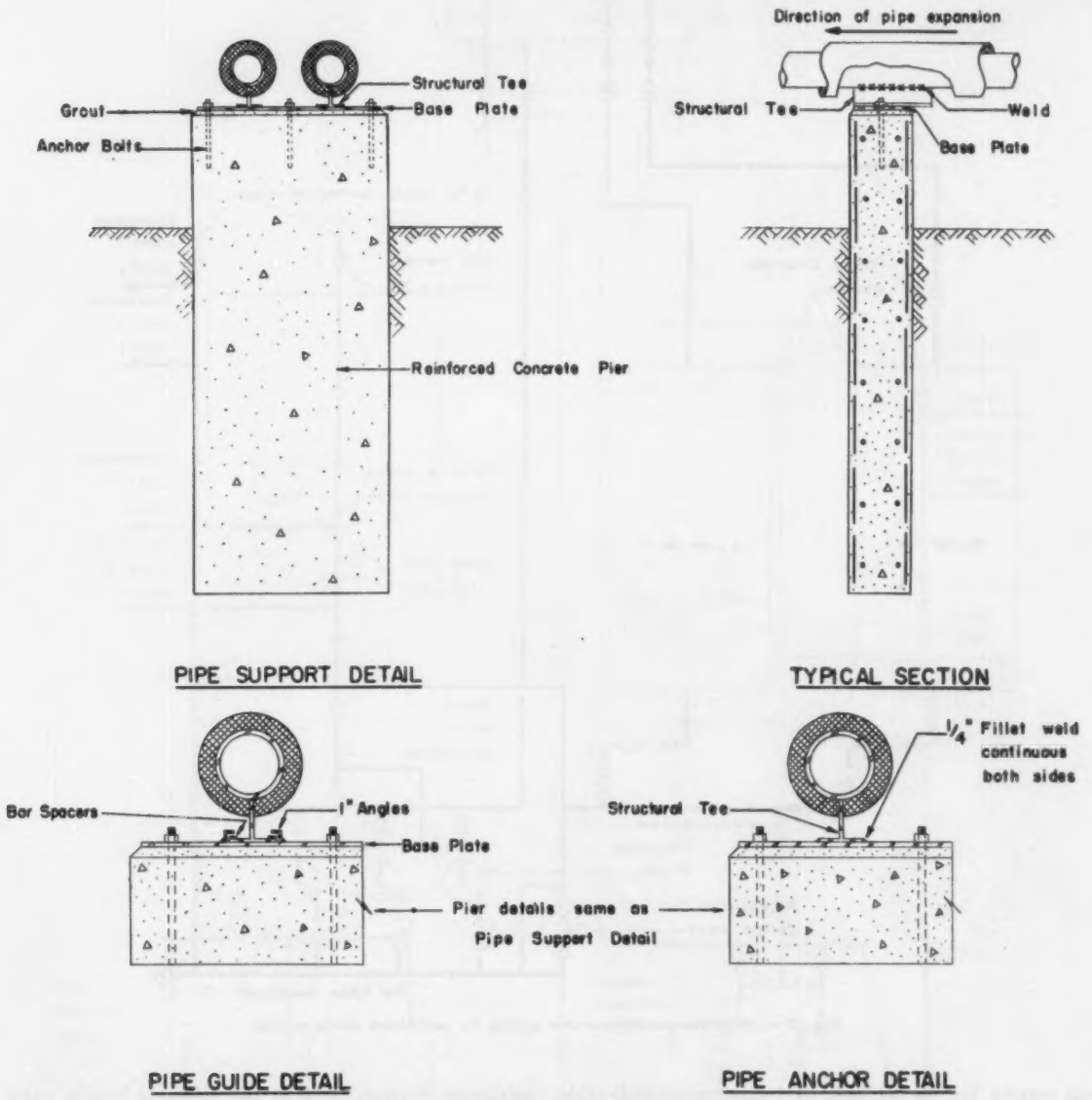

Fig. 3 — Typical distribution piping details

low load factor which on a combined-pump system requires the pump to operate at the higher head required by the distribution system, while in the meantime, circulating the major portion of its flow through the boiler. Consequently, the load factor and pumping characteristics of the system should be studied prior to selection of either pumping system.

Boilers and Boiler Control

In order to take full advantage of the characteristics of a high-temperature water system, the US Army Corps of Engineers has, in most instances, used only boilers of the forced or controlled flow, water tube type. However, it is believed that at somewhat lower pressures and temperatures than 275 psig and 414 F, natural circulation boilers will serve equally well. For military work, design plant capacity is determined by using an 80 percent diversity factor on automatically controlled space heating loads and a 65 percent factor on calculated utility loads, plus line and system losses. Boiler capacity is determined on the basis that the plant shall be capable of carrying 75 percent of total design load with the largest installed boiler out of service. In comparisons between high-temperature water and steam plants, steam boilers have been selected 10 percent greater in capacity than the high-temperature water boilers, to compensate for trap and venting or flashoff losses from condensate. In some instances the high-temperature water system can be reduced an additional factor because of its heat storage capacity, however, only where the peak load is not expected to extend over any considerable period of time and where the characteristics of the system are such as to take full advantage of this factor.

Controls selected for high-temperature water boilers have been of the air-operated medium type, controlling air and fuel in accordance with expansion drum pressure, boiler outlet water flow and temperature. The control systems have been arranged to permit each boiler to carry any desired portion of the total plant load or to permit *base loading* any unit.

Expansion Drums

Expansion drum design takes into consideration total system volume and maximum operating expansion expected from the system. The expansion drums provided should be capable of handling this expansion between the minimum and maximum controlled levels in the drum. The drum need not be sized to provide capacity for all expansion expected between the cold fill temperature and operating temperature of the system. This can be handled by blowdown from the drum as the system is initially brought up to temperature, vented and placed into operation. Each expansion drum must be protected from excessive high-water level by an automatic overflow controller consisting of a level control and valve which will automatically blow down in the event of high drum water level. Design of the drums should include an anti-vortex baffle on the system pump suction connection and blowdown collector for drawing blowdown from the full length of the bottom of the drum.

Water Treatment

Only a small amount of makeup is required by high-temperature water systems, therefore, extensive water treatment is not required. However, treated water storage equal to approximately 20 percent of the system volume is provided for emergency makeup or for normal makeup in the event of failure of the water service to the plant.

Water for Bearing Cooling

The quantity of water required for water-cooled bearings on pumps and fans can add considerably to the cost of operation especially where water costs are high. This expense can be cut materially by the inclusion of water cooling equipment in a closed bearing-water system, with supply from the treated water storage tank. This together with emergency generating equipment will permit the plant to operate as an independent isolated unit under emergency circumstances.

Compressed air facilities are similar to those in other central heating plants except that all soot blowing is by air since no steam is generated for this service.

Distribution System

In design of the distribution piping systems, flows are determined from the building heat consumer loads without application of diversity factors and by using the net temperature drop expected at the building. Lines are sized by computing pressure drop by Fanning's formula. The actual calculations involved may be considerably simplified by developing curves for the various line sizes on logarithmic paper in terms of pressure drop in lb per sq in. *vs.* water flow in pounds per hour. Correction factors for variations in water temperature and pipe schedule number are then used to adapt the curves to the various conditions encountered. Line heat losses are compensated for by using a lower net temperature drop and allowing for the increased flow. Usually the head available from the system distribution pump is allocated as follows: ¼ of the available head is used for piping within the central plant, ¼ for piping within the respective building heat consumers and ½ is allocated for design of the distribution system. Normally the pressure drops within the plant and utility rooms will not equal the 50 percent of the available pump head allocated for this purpose and consequently a small factor of safety is available when designing the distribution lines for 50 percent of the available pump head.

The piping is designed and installed without cold springing in accordance with the *ASA* Code for Pressure Piping and is hydrostatically tested at 600 psig. In general, welded joints and fittings are used throughout. However, *ASA* 300-lb standard flanges and flanged fittings are used where required for dismantling equipment for repair and maintenance.

Air bottles and valved vent connections are provided at all high points and valve drain connections at all low points for venting and draining the system. Once a system is placed in operation and properly vented, very little air accumulates and a minimum amount of feeding of a scavenging agent such as sodium sulphite eliminates any corrosive tendencies of the water.

Heat Consuming Equipment

The heat consuming equipment supplied by high-temperature water central heating plants on military installations consists almost entirely of water to water converters for supplying medium temperature water to most of the building heating systems, and for supplying ethylene-glycol mixtures to ice and snow melting coils, hot water generators for supplying domestic hot water, steam generators for supplying steam for cooking and sterilizing and to coils heating outside air in the colder climates, and unit heaters for direct heating. Controls for the high-temperature water side of these units are of the pneumatic type. Air is provided by an air compressor in each utility room or building where controlled air is required. Temperature controllers for water converters are of the adjustable proportioning type with automatic reset. Valves used are of the industrial cast steel single-seated type with stainless steel trim.

Summary

In summary, it is believed that military installations have done much to prove the practicability of heating systems using high-temperature water. These installations will serve as a source of valuable information on the operation, maintenance and efficiencies of high-temperature water systems. Such data will permit high-temperature water installations to enter a new era devoid of the extravagant claims, by which every unfamiliar system is plagued, and will be increasingly used for those installations where it is truly applicable in other public and private applications.

INDUSTRIAL VENTILATION CONFERENCE

The 7th Annual Industrial Ventilation Conference being held at Michigan State University, East Lansing, Mich., February 17-20, is expected to attract the usual large enrollment.

The program shows a number of Society members included on the staff of the Conference as follows: F. N. Calhoon, Ann Arbor, Mich.; G. L. Jepson, Kalamazoo, Mich.; J. R. Kayse, Louisville, Ky.; D. M. Long, Barrington, N. J.; J. D. McKichan, Marquette, Mich.; Lorin G. Miller, East Lansing, Mich.; C. H. Pesterfield, East Lansing, Mich.; W. J. Rettenmier, Detroit, Mich.; K. E. Robinson, Detroit, Mich.

DEMAND FOR ENGINEERS — 1957

Engineers Joint Council has announced that copies are available on request at $1.00 each of its Report No. 108 entitled *Demand for Engineers* — 1957.

The study is based on a sample drawn from 407 industrial firms and 69 governmental agencies employing over 175,000 engineers. The report presents in summary form the data obtained together with an evaluation and comments concerning it.

Starting salaries for inexperienced engineering graduates are also reported. Requests for copies should be sent directly to *Engineers Joint Council*, 29 West 39 Street, New York 18, N. Y.

TWO SECTIONAL SOCIETIES JOIN *EJC*

Two well-known sectional engineering societies, namely, the *Western Society of Engineers*, founded in 1869, and the *Engineering Societies of New England*, founded in 1922, have joined *Engineers Joint Council*, bringing the total membership of the Council to 17 societies. ASHAE is one of the 17, having joined the Council a year ago.

EJC STATES RULE ON TAX DEDUCTIONS FOR SOCIETY ACTIVITIES

The following is a statement of information as received by *Engineers Joint Council* and confirmed by legal counsel to the Society:

The Internal Revenue Service under ruling 55-4, I.R.B. 1955-1 states that a taxpayer *who gives his services gratuitously to an association, contributions to which are deductible* under the relevant provisions of the Code *and who incurs unreimbursed traveling expenses, including the cost of meals and lodging, while away from home in connection with the affairs of the association and at its direction may deduct the amount of such unreimbursed expenses in computing his net income;* subject, however, to the limitations in respect to all gifts made to exempt organizations of our type; namely, that the total amount of such gifts made in any one year may not exceed 20 percent of the donor's gross income for such year. This limitation means that while such expenses are deductible they are included with other gifts in computing the 20 percent limitation.

From this, it will be seen that members serving on Society committees may be justified in entering deductions in 1957 tax returns.

10TH REFRIGERATION INDUSTRY SHOW BREAKS RECORDS

With the largest display in its history, the Exposition of the Air Conditioning and Refrigeration Industry held at Chicago in late November drew a total attendance of nearly 15,000. Visitors came from every state in the Union, Canada, and about 25 foreign countries.

The show was sponsored by *ARI* and 8 other national trade associations, as well as *ASRE*. Exhibits emphasized the importance of the refrigeration cycle with emphasis on food preservation, drugs, industrial production and air conditioning.

It was also announced that the 11th Exposition will be held in Atlantic City late in 1959 or early in 1960.

Cooling Load from Pretabulated Impedances

by Harry Buchberg*, Los Angeles, Calif.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, in cooperation with the Department of Engineering, University of California, Los Angeles.

SUMMARY—A method for computing cooling loads using pretabulated complex impedance characteristics of typical wall construction is presented. The solution of a thermal network representing the heat transfer paths in a one room frame dwelling based on sinusoidal steady state inputs is compared to a more exact solution obtained with a d-c network computer. The ability to achieve good engineering accuracy in cooling load prediction, when using the fundamental inputs only, is demonstrated for one example. From the results shown it can also be inferred that peak loads which are influenced strongly by heat flux through an East- or West-facing weather wall of light construction can be considerably underestimated when neglecting all higher input harmonics.

THE STATUS of the thermal network approach to the solution of heating and cooling problems arising in the air-conditioning industry may be summarized by listing the various techniques that can be employed to solve the network. Regardless of the technique of solution the starting point is the thermal network representation of the physical system and all of the limitations inherent in the network apply. The response of the network to periodic inputs has been computed by:

1. Solving the simultaneous node equations based on current continuity.[1]
2. Making direct measurements on an analogous electric network.[2]
3. Solving the differential equations written for the network using an electronic differential analyzer.[3,4]

Solutions of the thermal network have also been obtained by summing the response of the network to a series of pulses representing transient inputs.[5]

Basically the 2 approaches taken to achieve a solution of the thermal network are on the one hand a summation of response to periodic steady state inputs and on the other hand the summation of response to pulse or transient inputs. The method of solution used in any instance depends on the following factors:

1. Objectives of the study being made and the number of solutions required.
2. Importance of transients in any particular design problem.
3. Particular computing experience and background acquired by available personnel.
4. Availability of particular types of computers.

For example, a design study to determine the optimum building characteristics including orientation, shading, surface treatments, location of openings, amount and location of thermal resistances and capacitances to minimize equipment operating costs will generally require a different computational procedure than the field determination of a cooling load. Furthermore, the type of computer available and particularly the previous experience of personnel undertaking the work influences greatly the choice of computational method. One organization because of previous experience with a particular computer may find it very economical to proceed in a certain manner while another organization may find the same computational procedure to be very costly.

New Method Proposed

The opinion of the writer at this time is that direct measurements on an analogous electric network offers the greatest flexibility and economy for the treatment of design problems where many solutions of a network may be required to evaluate design parameters. On the other hand, for the determination of equipment operating loads, a computational procedure utilizing a maximum amount of previously computed and tabulated information is most desirable. With this objective in mind the complete thermal network representing an enclosed space was conceived of as a system of many 4-terminal networks in parallel, each 4-terminal network representing a heat conduction path into or out of the space as shown in Fig. 1.

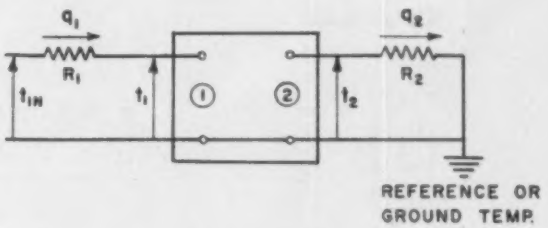

Fig. 1 — Conduction path network represented as a 4-terminal network

Coupling of the networks at the inside and outside boundaries takes place through convection and radiation paths (see Fig. 2). If the inside space temperature is considered to be constant and uniform through-

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[1]Exponent numerals refer to References.
For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 1958.

out the space it becomes convenient to designate that temperature as the reference or ground potential and each of the 4-terminal networks are then coupled through the ground connection. Additional coupling occurs when radiation exchange is considered.

A solution of the complete thermal network consists of summing up the instantaneous contributions q_2 for all times of interest. The influence of heat sources and sinks can be separately evaluated and included in the final solution by superposition. It is understood that all of the conduction path networks have only linear elements. If t_{1n}/q_2 is designated as the transfer function of any heat transfer path Equation 1 can be demonstrated (see reference 6).

$$\frac{t_{in}}{q_t} = Z_{22} + \left[1 + \frac{Z_{11}}{R_1}\right]\left[1 - \frac{Z_{22}}{R_2}\right]\left[\frac{R_1 R_2}{Z_{12}}\right] \quad \text{.....(1)}$$

where

$Z_{11} = t_1/q_1$ for $q_2 = 0$ (open circuit at terminal No. 2)
$Z_{22} = t_2/q_2$ for $q_1 = 0$ (open circuit at terminal No. 1)
$Z_{12} = t_1/q_2$ for $q_1 = 0$ (open circuit at terminal No. 1)

R_1 and R_2 are convective resistances. Z_{11}, Z_{22}, and Z_{12} are complex impedances characteristic of the 4-terminal network only and are functions of input frequency. This means that Z_{11}, Z_{22}, and Z_{12} can be determined for typical wall constructions and tabulated in a manner similar to steady state conductances. These impedances are entirely independent of the boundary resistances R_1 and R_2 which should be evaluated separately for each situation. For exterior walls t_{1n} is time variable and dependent on weather conditions, radiation exchange with the surroundings, and solar radiation absorbed. The convective resistance R_1 is a function mainly of air speed over the exterior surface and R_2 is a function mainly of the difference in t_2 from the reference or inside space temperature.

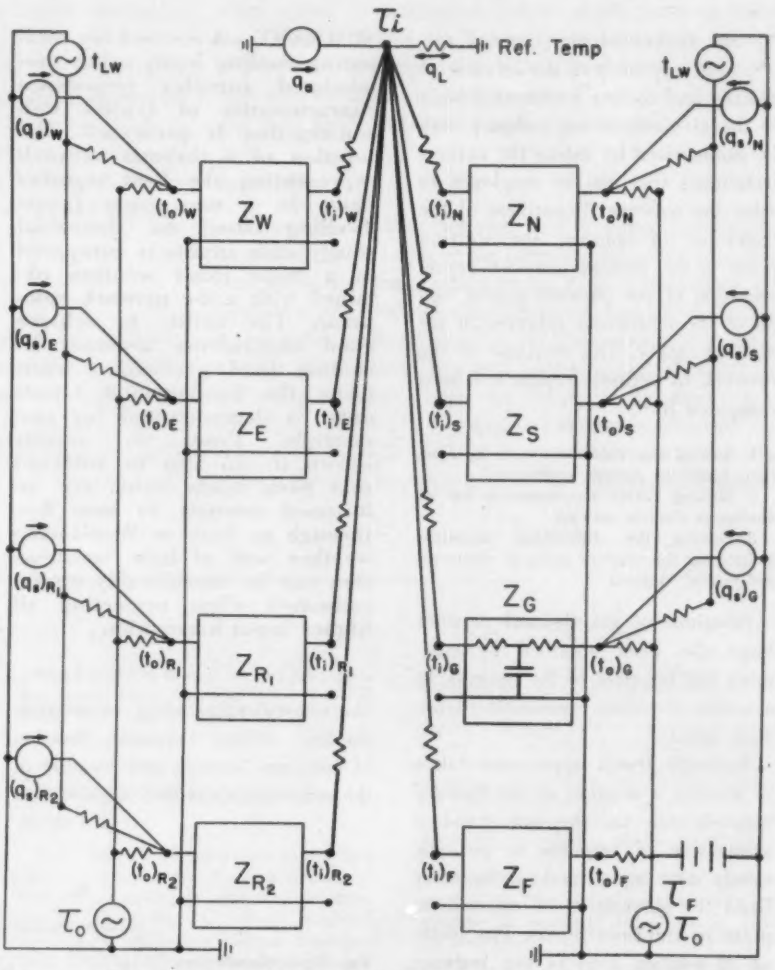

Fig. 2 — Thermal network representing the idealized test house without inside radiation exchange

Nomenclature

C = heat capacity, Btu per Fahrenheit degree.
q = heat flux, Btu per hour.
q_a = interior heat source, Btu per hour.
q_l = sensible cooling load, Btu per hour.
q_s = solar input or direct solar energy absorbed by an exposed surface, Btu per hour.
R = resistance to heat transfer, Fahrenheit degrees per Btu per hour.
t_i = inside surface temperature, Fahrenheit.
t_o = outside surface temperature, Fahrenheit.
t_{LW} = outside long-wave radiation potential, Fahrenheit.
Z = conduction path thermal impedance, Fahrenheit degrees per Btu per hour.

Greek Letters

θ = time
τ_i = inside ambient air temperature, Fahrenheit.
τ_o = outside ambient air temperature, Fahrenheit.
τ_F = under floor ambient air temperature, Fahrenheit.

Subscripts

E = east wall.
F = floor.

Symbols

= source of constant temperature, or potential
= source of periodically varying temperature, or potential
= heat or current source
= thermal resistance
= thermal capacitance
= ground or reference potential

To summarize: given a design input t_{1n}, appropriate values of R_1 and R_2, and values of Z_{11}, Z_{22}, and Z_{12} characteristic of the construction being used, the instantaneous sensible heat flow in or out of the space contributed by a particular wall can be determined from the relation shown, Equation 2.

$$q_t = \frac{t_{in}}{Z_{12} + \left[1 + \frac{Z_{11}}{R_1}\right]\left[1 - \frac{Z_{22}}{R_2}\right]\left[\frac{R_1 R_2}{Z_{12}}\right]} \qquad (2)$$

This kind of computation can be made by using a hand calculator once tabulations are made of the characteristic complex impedances. Only 3 tabular entries, Z_{11}, Z_{22}, Z_{12}, have to be made for each type of wall section providing sufficient accuracy is obtained through representing t_{1n} as the sum of a d-c component and the fundamental sinusoid only. Additional harmonics would require additional entries, 3 for each frequency. The complex impedances Z_{11}, Z_{22}, and Z_{12}, can be determined by direct measurement on model sections, by measurements made on an analogous electric network (network computer), or by various analytical approaches.

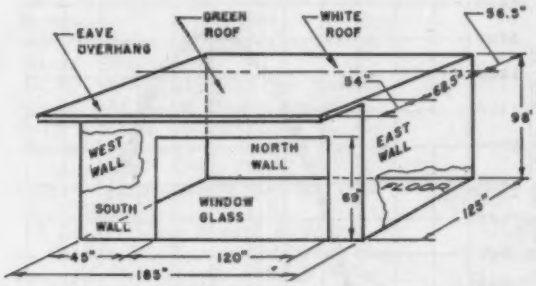

Fig. 3 — Schematic diagram of test house

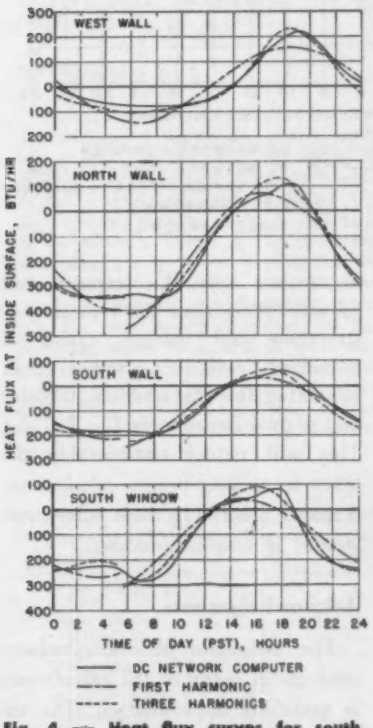

Fig. 4 — Heat flux curves for south, north, and west walls

Example Solution

Because the complex impedances are functions of input frequency, it is desirable to determine the importance of harmonics in an actual load determination. In this study, the transfer functions of the various wall, roof, and floor sections of a one-room wood frame dwelling (described in detail in Reference 2 and shown in Fig. 3) were determined by Laplacian transformation methods applied to a lumped *RC* ladder network. The thermal network representing the test house is shown in Fig. 2. Two sets of transfer functions (one for daytime conditions and one for night) were computed for each structural section except the east wall and floor. This was necessary to take into account the change in boundary resistance from day to night because of different average wind velocities. The conduction path networks, values of resistance and capacitance, and transfer functions computed are given in Appendix A. Contributions to the sensible cooling load by each of the structural sections and the resulting total cooling load as a function of time were computed using the sol-air inputs based on test house measurements made during a 24-hr period beginning September 8, 1953.[2] The sol-air inputs were computed according to the method outlined in reference 7 and correspond to the actual inputs used on the d-c network computer when solutions were obtained for comparison. The sol-air inputs computed for the various orientations are given in Appendix B.

Results and Discussion

The results of the hand computations are presented in Figs. 4 through 6. Three determinations of heat fluxes and sensible cooling load as a function of time of day are presented, *viz*: the d-c network computer prediction, the prediction based on

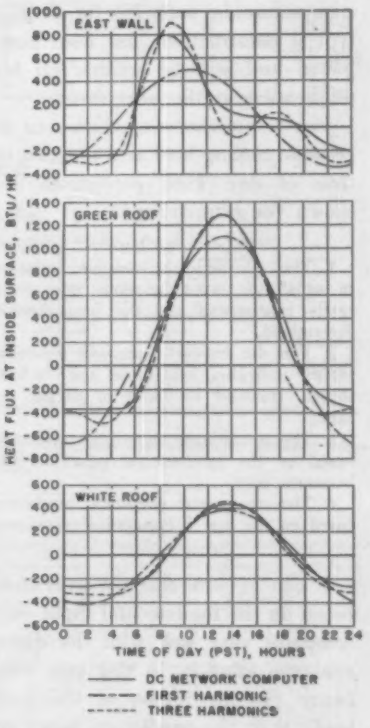

Fig. 5 — Heat flux curves for roof sections and east wall

the fundamental input only, and the prediction based on the first three harmonics. The discontinuities in the heat flux and load curves resulted from the shift in boundary resistance from night to day and day to night values. The cooling load is based on maintaining a constant space temperature of 76 F. The heat source, q_A, was constant with time and equal to 1280 Btu per hr.

Examination of the separate wall heat flux curves in Figs. 4 and 5 indicates that the peak load prediction based on the fundamental input only is lower than the more accurate d-c network solution in all cases. The greatest deviation occurred for the East wall. The attenuation of the higher harmonics due to the insulation is apparent from the West wall curves. Due to lack of insulation in the East wall one would expect the higher harmonics to exert more influence for this orientation in this example. A more complete study of the importance of input harmonics in steady state sinusoidal solutions for various typical constructions has been completed and will be written up for publication in the near future.

Fig. 6 presents the predictions of sensible cooling load as a function of time of day. Four predictions are shown for comparison:

1. The d-c network computer solution in which the input functions were accurately represented and the load directly determined.
2. The d-c network computer solutions for the individual heat fluxes and the heat source, summed by hand to obtain the load.
3. The steady-state sinusoidal prediction based on the fundamental input or first harmonic only.
4. The steady-state sinusoidal prediction based on the first 3 harmonics.

It can be seen that the prediction based on the fundamental input only compares very well with the direct analogue solution, in this case even better (in the region of the peak load) than the prediction based on representation by 3 harmonics. Harmonics appear to be much more important during the night hours which becomes apparent when examining the input curves. The 3 determining factors in assessing the importance of harmonics in any situation appear to be:

1. Shape of the input functions,
2. Degree of attenuation of the higher harmonics by the RC network representing the conduction path, and
3. Size of the individual heat flux contributions compared to the total instantaneous load.

Comparison between predictions (1) and (2) (given in Fig. 6) give some idea of the consistency of solutions with the d-c network computer. The differences in the curves arise from errors in reading the tapes for the separate heat fluxes.

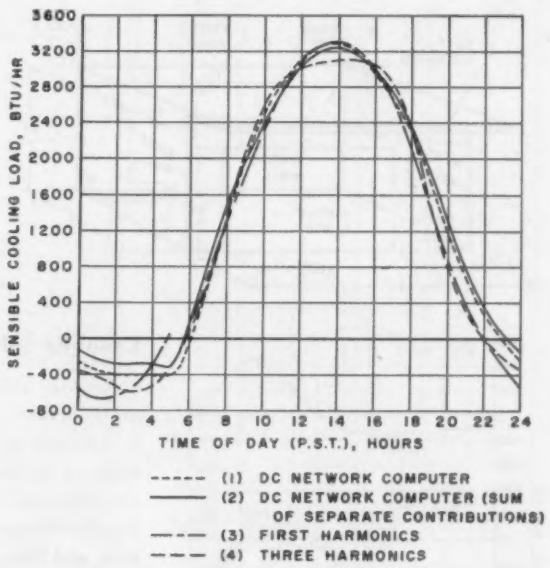

Fig. 6 — Comparison of cooling load curves

It should be pointed out that one of the greatest limitations of the steady-state sinusoidal method is the difficulty of handling an inside radiation exchange network. The writer has thus far not been able to find a simple computational procedure other than usual reiterative methods. The network solved in this study did not include inside radiation exchange. Another procedure that can be followed is to somehow adjust the inside boundary resistances to include radiation in the manner used in steady state calculations. In the writer's opinion, the best treatment of inside radiation exchange remains the incorporation of an inside resistance coupling network and solution with a d-c network computer.[2] Steady-state radiation sources, however, can be handled simply with the steady-state sinusoidal method.

Subsequent to these studies it has been found that the most economical procedure for applying the sinusoidal steady-state method is to determine the transfer functions, t_{1n}/q_2, directly on an a-c network computer and tabulate these data for typical constructions and various values of boundary resistance rather than tabulating the characteristic transfer and mutual impedances Z_{11}, Z_{22}, Z_{12}. This will reduce considerably the labor in making design calculations. A paper describing these subsequent studies is now in process.

Acknowledgments

The assistance of undergraduate students in many of the calculations is gratefully acknowledged. The author is also indebted to Dr. Don

Lebell for several suggestions involving network theory.

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APPENDIX A

The conduction path networks included a single tee, a double tee, and a triple tee as shown in Fig. A-1. The values of thermal resistance and capacitance used in the solutions are given in Table A-1. The transfer impedances t_{in}/q for each of the networks shown in Fig. A-1 were determined in terms of the resistances, capacitances, and input frequency by standard Laplacian transformation methods. For each structural section, the appropriate values of C and R were substituted and the transfer impedance was reduced to an amplitude ratio and phase angle. These are given in Table A-2 for each structural section and for the first 3 input harmonics.

Table A-1 — Values of thermal resistance and capacitance for all building components

Structural Components	Resistance, Fahrenheit per Btu (hr)					Capacitances, Btu per F deg		
	R_1 (Day)	R_1 (Night)	R_2	R_3	R_4	C_1	C_2	C_3
South Window	0.01187	0.0285	0.0459			17.7		
Floor	0.0238	0.0238	0.0134			171		
White Roof	0.00800	0.00875	0.00768	0.00560		12.5	77.7	
Green Roof	0.00725	0.01275	0.00635	0.00485		14.0	94.0	
West Wall	0.01150	0.0251	0.0737	0.0700	0.0309	90.8	32.4	29.6
East Wall	0.0152	0.0152	0.01056	0.00675	0.0309	90.0	0.288	28.3
North Wall	0.00534	0.01372	0.00458	0.00713	0.0254	94.0	0.416	133
South Wall	0.00975	0.0248	0.00845	0.0131	0.0449	48.2	0.344	72.6

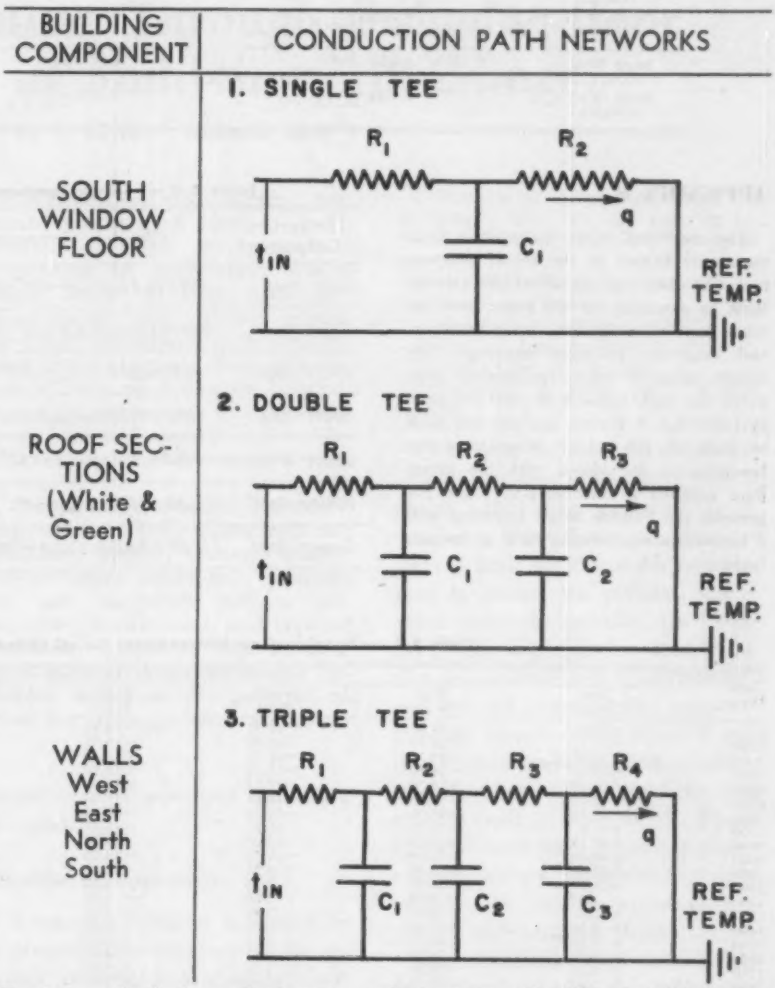

Fig. A-1 — Conduction path networks used to represent the different building components

Table A-2 — Transfer impedance factors for all structural components

Building Component	Transfer Impedance, $t^{in}/_q$		
	1st Harmonic	2nd Harmonic	3rd Harmonic
South Window (Day)	0.0576 /2.5°	0.0576 /5°	0.0581 /7°
South Window (Night)	0.0741 /5°	0.0750 /9°	0.0763 /14°
White Roof (Day)	0.0744 /15°	0.0813 /29°	0.0913 /40°
White Roof (Night)	0.0750 /16°	0.0825 /30°	0.0938 /41°

(*continued on p. 120*)

Table A-2 (*continued*) — Transfer impedance factors for all structural components

Green Roof (Day)	0.0645 /16°	0.0706 /30°	0.0805 /41°
Green Roof (Night)	0.0675 /4°	0.0679 /8°	0.0663 /13°
West Wall (Day)	0.215 /47°	0.296 /84.7°	0.435 /113°
West Wall (Night)	0.218 /53.2°	0.390 /84.1°	0.515 /108°
East Wall	0.0586 /16°	0.0616 /31°	0.0688 /45°
North Wall (Day)	0.0466 /26°	0.0545 /47°	0.0672 /63°
North Wall (Night)	0.0590 /37°	0.0792 /62°	0.1074 /80°
South Wall (Day)	0.0831 /23°	0.0975 /39°	0.1138 /48°
South Wall (Night)	0.1060 /31°	0.1338 /47°	0.158 /55°

APPENDIX B

The combined input temperature (t_{in}) commonly known as the sol-air temperature was computed for all of the orientations by summing up the input contributions due to convection, solar radiation, and long-wave radiation exchange. The hourly values of sol-air temperature computed for each exposed surface are given in Table B-1. A Fourier analysis was made of each of the sol-air temperature-time functions in accordance with the procedure outlined in Reference 7. Table B-2 presents the Fourier Series functions with 3 harmonics representing each of the surfaces.

Table B-2 — Sol-air temperature-time Fourier series functions

Structural Component	*Sol-Air Temperature-Time Fourier Series Functions*
East Wall	$490+24.6\cos(\omega_0\theta-142^\circ)+17.2\cos(\omega_1\theta+135^\circ)+11.6\cos(\omega_2\theta-14^\circ)+\cdots\cdots$
West Wall	$0.64+32.1\cos(\omega_0\theta+133^\circ)+18.6\cos(\omega_1\theta-112^\circ)+9.61\cos(\omega_2\theta-17^\circ)+\cdots\cdots$
North Wall	$-8.84+13.04\cos(\omega_0\theta+141^\circ)+3.97\cos(\omega_1\theta-112^\circ)+1.94\cos(\omega_2\theta-85^\circ)+\cdots\cdots$
South Wall	$-8.59+12.38\cos(\omega_0\theta+142^\circ)+3.57\cos(\omega_1\theta-101^\circ)+1.42\cos(\omega_2\theta-94^\circ)+\cdots\cdots$
South Window	$-8.80+11.1\cos(\omega_0\theta+134^\circ)+3.72\cos(\omega_1\theta-108^\circ)+1.42\cos(\omega_2\theta-107^\circ)+\cdots\cdots$
White Roof	$-1.56+30.2\cos(\omega_0\theta+171^\circ)+6.98\cos(\omega_1\theta-12^\circ)+1.17\cos(\omega_2\theta-24^\circ)+\cdots\cdots$
Green Roof	$12.89+58.0\cos(\omega_0\theta+176^\circ)+16.3\cos(\omega_1\theta-2^\circ)+3.56\cos(\omega_2\theta+4^\circ)+\cdots\cdots$

Table B-1 — Hourly sol-air temperatures for all exposed surfaces

Time Hours	Sol-Air Temperature[a], Fahrenheit — 76 deg						
	East Wall	West Wall	North Wall	South Wall	South Window	Green Roof	White Roof
0	−16.81	−20.89	−19.37	−18.41	−17.33	−24.41	−28.05
0100	−16.75	−20.53	−19.28	−18.55	−17.27	−24.41	−28.05
0200	−15.69	−19.28	−18.18	−17.30	−16.30	−23.69	−26.78
0300	−15.19	−18.69	−17.64	−16.70	−23.11	−25.48	−15.74
0400	−14.69	−18.72	−17.64	−16.70	−23.11	−25.48	−15.80
0500	−16.10	−19.56	−18.62	−17.73	−23.96	−27.27	−16.77
0600	+59.15	−15.29	−14.11	−15.08	−12.78	− 3.85	−15.04
0700	+61.0	−15.10	−15.07	−14.85	− 2.82	+19.03	−15.90
0800	+52.14	−13.76	−14.06	−13.74	+ 6.74	+38.78	−15.32
0900	+40.50	−11.19	−11.70	−11.25	+15.11	+55.10	−13.29
1000	+27.16	− 5.84	− 6.96	− 6.42	+24.15	+69.65	− 8.80
1100	+13.12	− 0.96	− 2.34	− 1.94	+30.05	+78.20	− 4.37
1200	+ 1.47	− 6.48	− 1.60	− 2.01	+34.60	+83.70	− 0.41
1300	+ 3.86	−24.05	+ 3.89	+ 4.25	+34.73	+80.87	+ 1.98
1400	+ 3.66	+37.10	+ 4.06	+ 4.34	+30.64	+72.60	+ 2.40
1500	+ 2.85	+47.70	+ 4.13	+ 4.24	+24.27	+57.73	+ 2.85
1600	+ 2.59	+54.64	+ 4.61	+ 4.60	+16.67	+39.81	+ 3.74
1700	+ 2.30	+59.53	+ 5.60	+ 5.40	+ 6.40	+15.71	+ 5.11
1800	+ 1.87	+57.98	+12.12	+ 5.31	− 3.90	− 6.83	+ 5.01
1900	− 2.51	−12.05	− 5.65	− 4.47	−11.86	−19.80	− 2.67
2000	−10.00	−17.44	−13.05	−11.89	−18.09	−25.36	−10.18
2100	−14.35	−20.17	−17.09	−15.93	−21.64	−27.90	−14.44
2200	−15.57	−20.70	−18.34	−17.22	−23.09	−28.53	−15.90
2300	−16.44	−21.88	−19.10	−18.05	−24.03	−28.42	−16.85

[a]Sol-air temperature inputs are reckoned with respect to a reference temperature of 76 F.

SEMI-ANNUAL MEETING

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from the RESEARCH LABORATORY

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Winter Infiltration Through Swinging-Door Entrances in Multi-Story Buildings

By T. C. Min*, Auburn, Ala.

SUMMARY—This paper presents results of a study of infiltration through swinging-door entrances in multi-story buildings, based on both field and laboratory tests under winter heating conditions. A procedure and the necessary data for the calculation of entrance infiltration are presented. An approximate general equation for the calculation of infiltration is also given.

Important variables determining entrance infiltration rate are building height, indoor-outdoor temperature difference, quantity of air supplied and/or exhausted, traffic rate, and type of building entrance. The infiltration through a vestibule-type entrance is about 55 percent of that for a single-bank entrance.

AIR INFILTRATION through entrances has been recognized as an important consideration in estimating heating and air-conditioning loads, especially for tall commercial buildings, in which chimney effects are large and heavy traffic prevails. Data presently available on infiltration[1-4] are limited, and the effects of vestibules, fresh air and exhaust fans, traffic rate, and human obstruction have not been fully evaluated. At the ASHAE Research Laboratory, work on entrance infiltration has been in progress since January 1956, under the guidance of the Technical Advisory Committee on Heating and Air-Conditioning Loads**. The purpose of the investigation is to provide basic information on air infiltration through entrances of commercial-type multi-story buildings. In this paper, the infiltration through various types of swinging-door entrances under winter heating conditions is reported. Infiltration through swinging-door entrances under summer cooling conditions is being studied, and a project on infiltration through revolving-door entrances is being planned.

Method of Approach

Entrance infiltration is caused by a pressure differential across the entrance, resulting from chimney effect, supply and/or exhaust fan operation, and wind pressure. For a given pressure differential, the volume of infiltration air passing through hinged-door entrances depends upon a number of variables, among which are the following:

1. Type of entrance: (*a*) single-bank doors; (*b*) vestibule.
2. Dimension of doors.
3. Arrangement of doors: (*a*) opposite-swinging; (*b*) parallel-swinging.
4. Direction of swinging of doors: (*a*) all swinging out; (*b*) one swinging in, the other swinging out; (*c*) all swinging in.
5. Depth of vestibule.
6. Size of door cracks.
7. Size and location of marquee.
8. Type of door operators or closers.
9. Traffic rate and pattern.
10. Tightness of other parts of the building.

In view of the many variables involved, the work was divided into 3 phases which were conducted simultaneously. Phase 1 was the development of draft factors[□] which could be used to predict the pressure differential across the entrance of a building of any height, at any outside design temperature and wind velocity, and for any inside design temperature and blower action. Phase 2 was the determination of flow coefficients[□] for doors of various types and at any angle of opening. In Phase 3, studies were made to develop a correlation between traffic rate and door position for various types of entrances and vestibule depths.

By combining the information from the 3 phases, the infiltration rate for any particular type of entrance, traffic rate, building height, outside weather conditions and blower effect could be determined.

Test Apparatus, Procedure, and Conditions

Phase 1: Pressure differential measurements were made in 23

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[1]Exponent numerals refer to References.

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For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 1958.

□The terms are defined in the Test Results.

building entrances in Cleveland and Pittsburgh during the months of January, February, November, and December of 1956 and January and February of 1957. Information regarding the height and cubical content of the buildings and the capacities of exhaust and fresh air supply fans was furnished by the building managers. Most tests were made during the day time under normal traffic and building operating conditions. For studying the effect of blower action, a few tests were run in the evenings when the exhaust and/or supply fans could be turned on and off as desired.

Fig. 1 — Laboratory equipment for studying air flow through scale model entrances

In determining pressure differentials, the outside pressure was sensed by the total-pressure opening of a Pitot tube located near the building and approximately 7 ft above the sidewalk. In most tests, the Pitot tube was pointed in a direction perpendicular to the building entrance. However, in a few tests it was pointed windward and leeward, and readings were taken at several points between the building and the curb.

In tests in Cleveland buildings, the Pitot tube was connected to a pressure transducer and an electronic recorder located inside the building entrance. In the other tests, a draft gage was substituted for portability. All of these instruments were calibrated at the Laboratory prior to their use.

The rubber tubing between the Pitot tube and the pressure meter was passed through the crack of the door in such a way that normal traffic could be maintained. Where the doors were very closely fitted and this was not possible, it was necessary to block off one set of doors and crack them slightly to pass the tubing.

Pressure differentials in the Cleveland buildings were recorded for 30-min intervals; and in some buildings, several recordings were made at different times during the day. In the Pittsburgh buildings, draft gage readings were taken at 15-sec intervals for 15 min.

Wind velocities were taken by a vane-type anemometer at the curb line in front of the entrance. Observations were made with the instrument first facing either windward, and then in a direction perpendicular to the entrance. The outside and inside wet-and dry-bulb temperatures were taken at the street level, the top of the building, and at 2 intermediate points.

Phase 2: For the second phase of the program, it was decided to investigate the flow coefficients of doors by a laboratory study of scale models. The equipment shown in Fig. 1 was constructed for the purpose. Models of single-bank doors were located in the face of the 4- × 5-ft test section, and an extension, shown in place in the figure, provided the location for a second set of doors for studying vestibule-type entrances. Air which entered through the doors passed through a bellmouth transition and a metering section to the fan inlet.

The static pressure in the test section was controlled by adjusting a cone-shaped damper in the fan discharge. The pressure inside the entrance was sensed through small holes in the top of a copper tube placed horizontally about 24 in. back of the doors and 9 in. above the floor.

The magnitude of the pressure was determined by the pressure transducer and recorder. Air flow was measured by an orifice plate in the metering duct. The entire setup was tested for leakage and proved tight.

To determine the feasibility of scale-model tests, a preliminary investigation was made with 1/6 and 1/4 scale models of a 3- × 7-ft single-door entrance. The results obtained with these models were found to agree well with results obtained from tests of a full scale door in the Laboratory.

In addition to the 2 single-door models just mentioned, a 1/6 scale model of a 4-door entrance was constructed and tested. In this model, a pair of 2 ½- × 7-ft, opposite-swinging doors was located at the center, and at each end was a 3- × 7-ft side-swinging door. Two identical panels were made of each arrangement, so that each could be tested as a single bank or vestibule type of entrance. In each entrance model, not only the doors, but the jambs, thresholds, and

Nomenclature

A = area of a door, square feet.
C_F = flow coefficient, dimensionless.
f_F = forced draft factor, dimensionless.
f_N = natural draft factor, dimensionless.
H = building height, feet.
N = number of doors per bank.
ΔP = pressure differential across the entrance, inches of water.
$\Delta P_{obs.}$ = observed pressure differential, inches of water.
$\Delta P_{theo.}$ = theoretical pressure differential, inches of water.
q_n = air flow through entrance, cubic feet per minute.
ρ_i = density of inside air, pounds per cubic foot.
ρ_o = density of outside air, pounds per cubic foot.

other details were constructed to scale.

All tests were made under steady conditions with doors set at various angular positions. For each combination of door positions, air flow was determined for at least 3 pressure differentials across the model entrance. Wet- and dry-bulb temperatures were measured by thermometers located in the metering duct.

Phase 3: Studies on the correlation of door position and traffic rate were conducted in 7 buildings in the downtown area of Cleveland during November and December 1956, and January 1957. One of the entrances studied had power-operated doors, one set of which swung in, and the other set of which swung out. The other 6 buildings had manually operated doors which swung out.

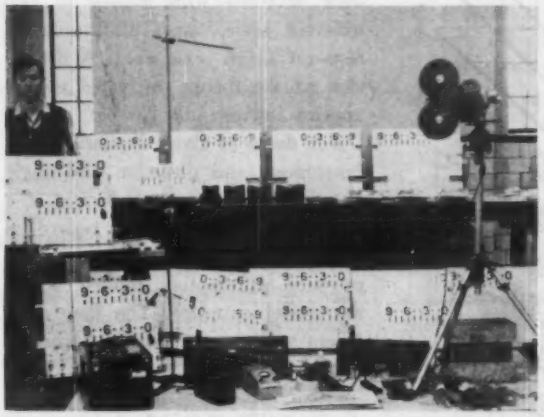

Fig. 2 — Equipment used in field tests of building entrances

Indicators, shown in Fig. 2 with other field test equipment, were built to show the position of the entrance doors to be studied. Fig. 3 shows the indicators for both the inner and outer banks of vestibule doors, mounted over the inner doors. Indicators were connected to the doors by a system of cords and pulleys, and were calibrated in place before the start of a test.

A 16 mm movie camera operating at a speed of 8 frames per second was used to take pictures similar to Fig. 3, showing the indicators and the people passing through the doors. At this operating speed, the 400-ft films used would last for 30 min continuous operation. The camera was actually operated intermittently for periods of 4 or 5 min each, at various times throughout the day, so that data could be obtained for various traffic patterns.

After the films were developed, the pictures were analyzed with the aid of a time-motion-study projector. Pictures could be advanced, one frame at a time, and a counter indicated the number of the frame being studied.

Test Results

Pressure Differential Across an Entrance: It was found from an analysis of the field test data that the pressure differential across a building entrance was related to the building height, and the difference between the indoor and outdoor air temperatures. It was also evident that the differential could be increased or decreased appreciably by the operation of exhaust or fresh air supply fans.

To correlate the pressure differential across an entrance with building height, temperature differential, and blower action, the observed pressure differential for each test was expressed as a percentage of the theoretical natural draft for the conditions of the test. This ratio is hereinafter referred to as a *draft-factor*.

The theoretical draft which is produced solely by the stack height and the difference in the densities of the cold outside and the warm inside air may be calculated by Equation 1.

$$\Delta P_{theo.} = 0.1924\ (\rho_o - \rho_i)\ H \quad \ldots\ (1)$$

The theoretical draft in buildings, heated to 75 F, of any height, and for any inside-outside temperature difference, may be determined from Fig. 4. The figure is based on air densities taken from Reference 5.

In Fig. 5, the observed pressure differentials resulting from chimney action only have been plotted against the theoretical drafts obtained from Fig. 4. A straight line drawn through the points for conventional buildings has a slope of 0.7, thus indicating a *natural draft factor*, f_N, of 0.7. One of the buildings tested was of metal curtain wall construction and had windows which were tightly sealed by inflated gaskets. This building had a draft factor of 0.3 as shown by the lower curve of Fig. 5. However, since only one building of this type was tested, it is not known if this lower factor would be typical for other buildings of similar construction.

Fig. 3 — Entrance showing door indicators and traffic

The operation of exhaust or fresh air supply fans tends to increase or

decrease the pressure differential across a building entrance caused by natural draft. Corrections for the natural draft factor, for various rates of air exhaust or supply, are given in Fig. 6. The corrected factors, or the *forced draft factors*, are also given in the figure.

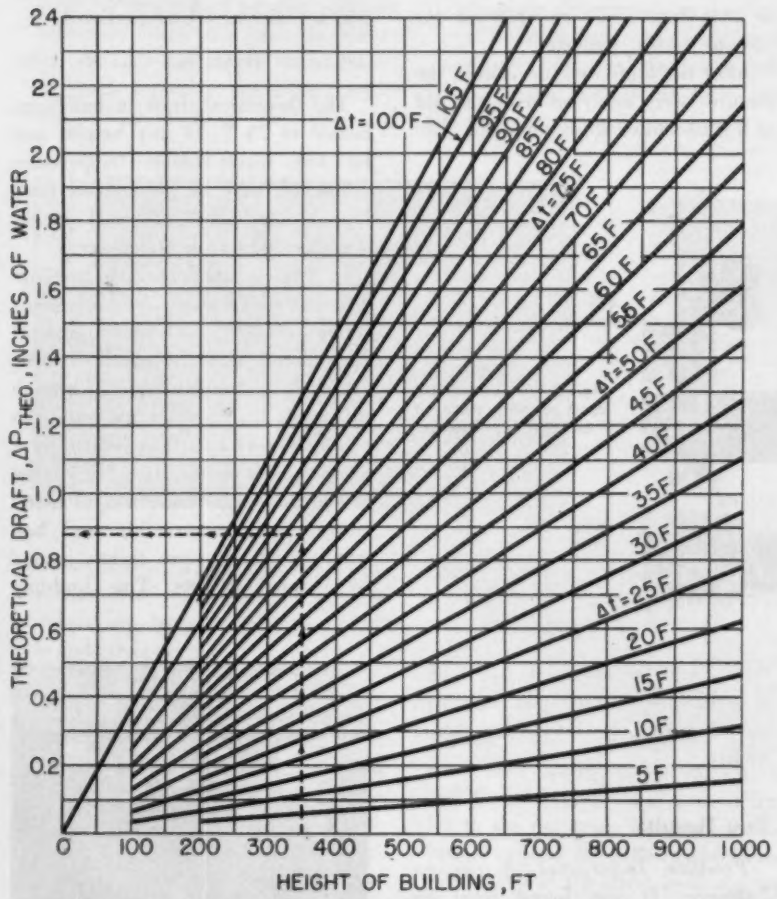

Fig. 4 — Theoretical draft in tall buildings due to chimney effect (Based on average inside air at 75 F, 50 percent RH, standard atmospheric pressure 29.921 in. Hg)

Wind velocity was found to have a negligible effect on the pressure differential in the congested business areas where the field tests were conducted. Although some tests were made on rather windy days when wind velocities of 20 mph were being recorded by the U. S. Weather Bureau, wind velocities measured windwardly at the curb line in front of the entrance were not more than 6 mph, and the maximum velocity normal to the entrance was only about 2 mph, which is equivalent to a pressure differential of less than 0.002 in. of water. The wind direction past the building entrance was found to be quite erratic.

No attempt was made to investigate the effect of vertical openings. However, the presence of large escalator openings in two of the buildings tested did not seem to cause any significant difference in the draft factors. It was also surprising to the investigators to find that the pressure differential remained essentially constant regardless of variations in the rate of traffic through the entrances. No effect of *elevator pumping* was observed.

Both the inside and outside air temperatures were found to be reasonably constant over the entire height of the buildings. The maximum variation observed was of the order of 5 F.

Flow Coefficients for Door Openings: As previously indicated, the feasibility of scale model tests was demonstrated by the comparison of data obtained with models at two different scales, with the results of tests on a full scale door. A discussion of the theory of model testing appears in Appendix A.†

For doors of given dimensions, arrangement, and direction and angle of opening, the flow coefficient, C_F, was found to be the same regardless of the scale of the model used, or the pressure differential applied across the model entrance. The flow coefficient may be defined by Equation 2.

$$C_F = q_a/4005\ NA\sqrt{\Delta P} \quad \ldots\ldots\ldots (2)$$

About 300 tests were made in the Laboratory on a 1/6 scale model of a 4-door single-bank entrance (type F1 in Fig. 7) to determine the flow coefficients for various door positions. Test data obtained on the performance of adjacent doors of various arrangements (opposite-swinging, parallel-swinging, one swinging in and the other out) were used to compute the coefficients for the various types of entrances shown in Fig. 7. The effect of adjacent doors, either parallel- or opposite-swinging, will be shown in Figs. B1 and B2 of Appendix B.†

Fig. 8 is a graph constructed for determining the flow coefficients for a 5-door entrance (type B1 of Fig. 7) for any combination of door positions. It is composed of 5 sets of curves. The first set, at the bottom of

†It is planned to publish the several appendixes mentioned when this paper is printed in the ASHAE TRANSACTIONS for 1958.

the figure, shows the performance of door "e" as a single door. The second set of curves, when entered at the point indicated by the "e" curves, gives the coefficient for the combined

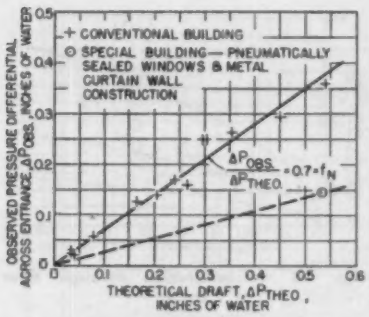
+ CONVENTIONAL BUILDING
⊙ SPECIAL BUILDING— PNEUMATICALLY SEALED WINDOWS & METAL CURTAIN WALL CONSTRUCTION
OBSERVED PRESSURE DIFFERENTIAL ACROSS ENTRANCE, ΔPOBS, INCHES OF WATER
ΔPOBS / ΔPTHEO = 0.7 · fN
THEORETICAL DRAFT, ΔPTHEO, INCHES OF WATER

Fig. 5 — Natural draft factor for building entrances

performance of doors "e" and "d". Similarly, the scale at the top of each successive set of curves indicates the combined coefficient for the door represented by the curves, in combination with all preceding doors.

thought that the relative locations of the open doors in the inner and outer banks, as well as the numerous combinations of positions of the doors in each bank, might be important variables in the study. However, it was found that the coefficient for the vestibule could be predicted from the coefficients for the inner and outer banks, regardless of the positions of the individual doors in each bank. For example, any combination of door positions in the 2 banks which gave individual bank coefficients of 0.3 and 0.4 would produce a vestibule coefficient of 0.225. Flow coefficients for vestibule entrances may be determined from Fig. 9, if the coefficient for each bank of doors is known.

A few tests were made with vestibules 4 ft and 16 ft deep in prototype. The results of these tests indicated that the depth of the vestibule had no significant effect on the infiltration through a building entrance. Tests were also made with a

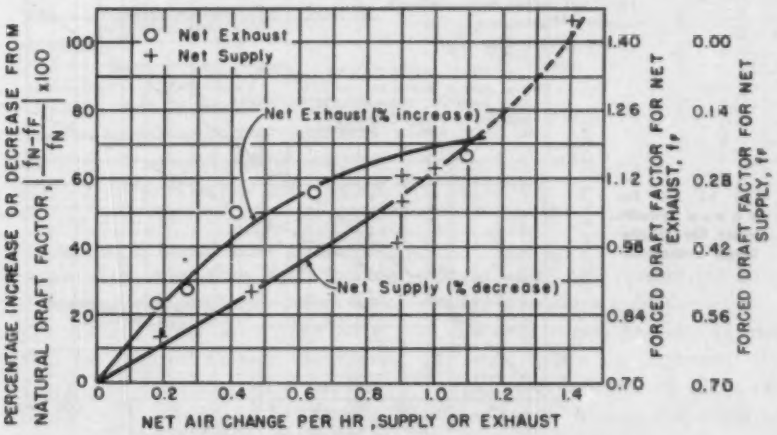
Net Exhaust
Net Supply
Net Exhaust (% increase)
Net Supply (% decrease)
PERCENTAGE INCREASE OR DECREASE FROM NATURAL DRAFT FACTOR, (fN−ff)/fN ×100
FORCED DRAFT FACTOR FOR NET EXHAUST, ff
FORCED DRAFT FACTOR FOR NET SUPPLY, ff
NET AIR CHANGE PER HR, SUPPLY OR EXHAUST

Fig. 6 — Effect of blower action upon pressure differential

Fig. 8 is typical of a number of graphs constructed for various entrance arrangements.

To determine the performance of a vestibule-type entrance, tests were made on a 1/6 scale model of a type F2 entrance having a vestibule depth of 8 ft in prototype. It was at first thought that the relative locations of the open doors in the inner and outer banks, as well as the numerous combinations of positions of the doors in each bank, might be important variables in the study. However, it was found that the coefficient for the vestibule could be predicted from the coefficients for the inner and outer banks, regardless of the positions of the individual doors in each bank. For example, any combination of door positions in the 2 banks which gave individual bank coefficients of 0.3 and 0.4 would produce a vestibule coefficient of 0.225. Flow coefficients for vestibule entrances may be determined from Fig. 9, if the coefficient for each bank of doors is known.

A few tests were made with vestibules 4 ft and 16 ft deep in prototype. The results of these tests indicated that the depth of the vestibule had no significant effect on the infiltration through a building entrance. Tests were also made with a marquee at several heights above the entrance, but no significant effects were found.

The flow coefficients as determined from Figs. 8 and 9 are for doors at the indicated positions but unobstructed by people passing through them. The effect of human obstruction was studied by placing a scaled human figure at various positions in a door opening. The results of these tests will be given in Appendix C. Other tests, in which 3 human figures were placed at various positions in an open doorway, indicated that the entire effect observed was created by the one figure which created the maximum obstruction.

Since the reduction of infiltration due to human obstruction depends upon the length of time the opening is obstructed, further discussion on the subject will be given with the results of the traffic analysis.

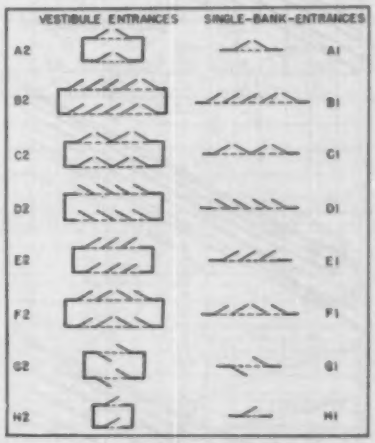

Fig. 7 — Types of entrances for which flow coefficients were calculated

A few tests were made to determine the infiltration through a full scale door crack 34½ in. long and adjustable in width up to ½ in. The results are given in Fig. 10.

Analysis of Traffic and Evaluation of Entrance Coefficients: In the field studies made to correlate traffic and door position, seven 400-ft films or a total of over 100,000 frames were taken at a speed of 8 frames per second. These pictures showed traffic at various rates passing through vestibule-type entrances having various door arrangements and vestibule depths. It was found that good accuracy could be obtained by the

analysis of every eighth frame (1 picture per second), and the results presented are therefore based on the examination of approximately 12,500 frames.

The analysis was made by projecting every eighth frame onto a screen, and noting the indicated position of each door in both the inner and outer banks. For each combination of door positions, the flow coefficient for each bank of doors was determined from a chart similar to Fig. 8, constructed for the particular entrance being studied. The traffic rates through the doors for certain selected sequences were also determined from the pictures.

From the data obtained from the pictures, *entrance coefficients* were calculated for the various entrances tested. An entrance coefficient may be defined as the flow coefficient corresponding to a given traffic rate through a given entrance.

Entrance coefficients for a single-bank entrance were determined by averaging the flow coefficients for the outer bank of vestibule entrance doors. A plot of these entrance coefficients *vs.* traffic rate is shown by the upper curve of Fig. 11. The flow coefficients for the outer bank of doors were used because it was felt that the outer bank more nearly represented the performance of single bank doors. In every building tested, the outer doors closed more rapidly than the inner doors, probably due in part to the adjustment of the door closers, and in part to the greater pressure differential acting on the outer doors. Field tests had indicated that most of the pressure differential across a vestibule-type entrance occurred at the outer

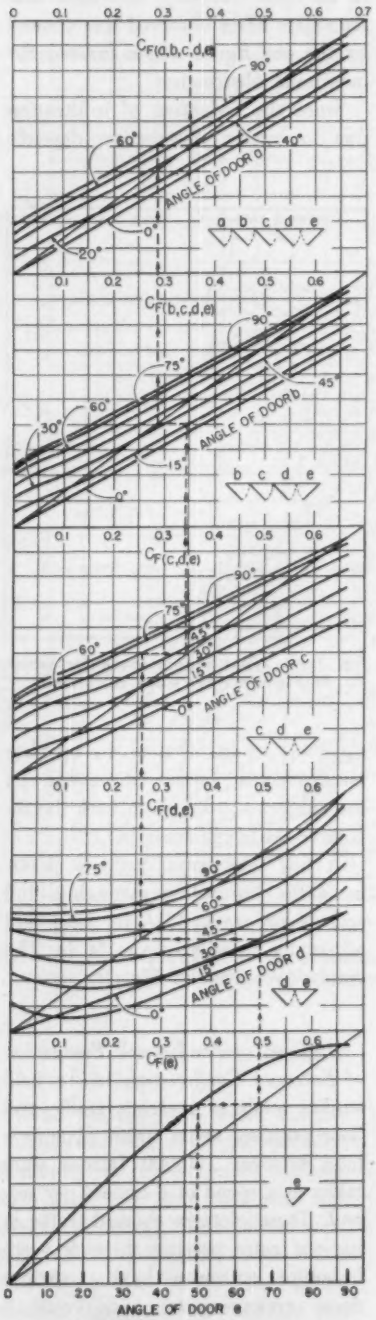

Fig. 8 — Chart for determining flow coefficients for type B1 entrance

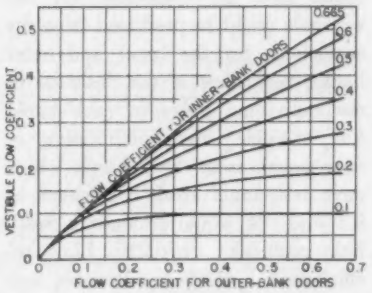

Fig. 9 — Flow coefficients for vestibule entrances

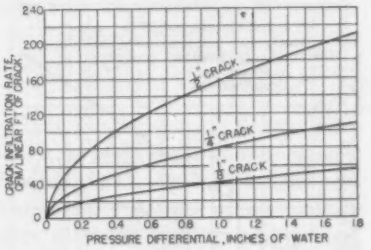

Fig. 10 — Infiltration through door cracks

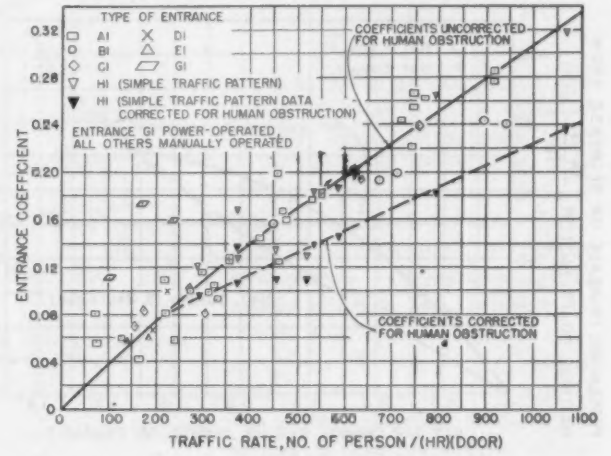
TYPE OF ENTRANCE
HI (SIMPLE TRAFFIC PATTERN)
HI (SIMPLE TRAFFIC PATTERN DATA CORRECTED FOR HUMAN OBSTRUCTION)
ENTRANCE GI POWER-OPERATED, ALL OTHERS MANUALLY OPERATED
COEFFICIENTS UNCORRECTED FOR HUMAN OBSTRUCTION
COEFFICIENTS CORRECTED FOR HUMAN OBSTRUCTION
ENTRANCE COEFFICIENT
TRAFFIC RATE, NO. OF PERSON / (HR)(DOOR)

Fig. 11 — Entrance coefficients for single-bank entrances

set of doors. Coefficients based on the inner doors would have been about 10 percent higher than those shown in Fig. 11.

Flow coefficients for vestibule-type entrances were determined from the separate flow coefficients for the inner and outer banks of doors by means of Fig. 9. The vestibule entrance coefficients shown by the upper curve of Fig. 12 were determined by averaging the vestibule flow coefficients for given traffic rates. An example of the determination of entrance coefficients will be given in Appendix D.

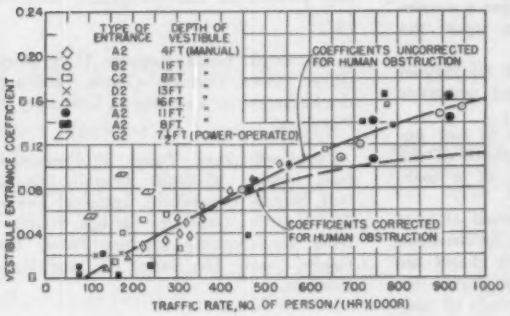

Fig. 12 — Entrance coefficients for vestibule entrances

To study the effect of human obstruction upon infiltration, it was decided to analyze only those sequences showing a simple traffic pattern of 1, 2, 3, or 4 people entering or leaving one door (or one set of doors in the case of the vestibule entrance) at about the same time. Each analysis started with the frame before the first person entered through the outer door (or departed through the inner door), and continued until the last person had completed the passage through the doors, and the doors were closed. The angles of door opening, as well as the position of each person relative to the doors, were noted; and the effects of the obstruction were determined and will be seen from Fig. C-1 of Appendix C. The lower curves of Figs. 11 and 12 were plotted on the assumption that the ratio of the corrected to the uncorrected entrance coefficients, as found for the simple traffic patterns studied, would hold for the more complex patterns. As shown in the figures, the effect of human obstruction is negligible at low traffic rates, and increases to approximately 25 percent with 1,000 persons per hour passing through each door.

The solid curves in Figs. 11 and 12 were drawn to represent the average coefficients for all of the entrances tested. A close inspection of the figures reveals that the solid curves also represent a reasonably good average for each of the entrances tested except those having power-operated doors, G1 and G2. It is therefore recommended that the entrance coefficient for any entrance having manually operated doors be determined from the curves of Figs. 11 and 12, regardless of door size or arrangement. The use of the broken curves, giving values corrected for human obstruction, is recommended for practical application.

The curves of Fig. 13 show the relationship between the effective (actual) pressure differential across an entrance, the entrance coefficient, and the infiltration rate per door. It should be noted that the infiltration rates shown in this figure are based on a 3- × 7-ft door. Infiltration through doors of other sizes will be proportioned to the door areas.

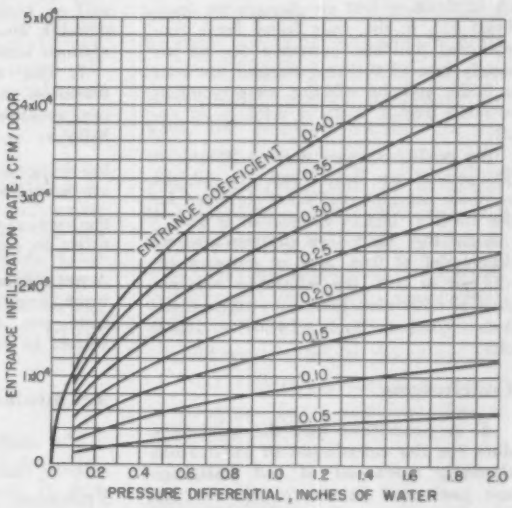

Fig. 13 — Entrance infiltration rates for various pressure differentials and traffic rates

Discussion

As indicated in Figs. 11 and 12, the entrance coefficients for the one set of power-operated doors tested were much higher than for manually operated doors. This is to be expected, since the power-operated door opens a full 90 deg each time a person passes through it, and remains open longer than the average manually-operated door. The increase in infiltration through power-operated doors will probably vary widely, depending upon the adjustment of the operating mechanism. It is also apparent that the effect of human obstruction will be less with power-operated than with manually-operated doors.

The data on infiltration through door cracks will be applicable only to entrances through which the traffic rate is very low.

Illustrative Example: ***Given:*** *A conventional building 350 ft high has a net cubage of 4,200,000 cu ft. Fresh air fans supply outside air at the rate of 80,000 cfm, and exhaust fans discharge 50,000 cfm. The building has a vestibule-type entrance having four 3- × 7-ft doors and the inside temperature is maintained at 75 F.* ***Find:*** *Infiltration rate through the entrance at a time when the outside temperature is zero F, and the traffic rate is 2,000 persons per hour.*

Solution: From Fig. 4, the theoretical draft for a 350-ft building height and a 75 F inside-outside temperature differential is 0.88 in. of water.

The net air supply rate is 80,000 − 50,000 = 30,000 cfm. This is 30,000 × 60/4,200,000 or 0.43 air changes per hour. From Fig. 6, the draft factor for a conventional building, corrected for an air supply rate of 0.43 air changes per hour is 0.525, and the effective pressure differential is 0.88 × 0.525 = 0.462 in. of water.

The traffic rate per door is 2000/4 = 500 persons per hour. From Fig. 12, the vestibule entrance coefficient corrected for the effect of human obstruction is 0.08.

From Fig. 13, for an effective pressure differential of 0.46, and an entrance coefficient of 0.08, the infiltration rate per door is 4,500 cfm. Infiltration through the 4-door entrance = 4 × 4,500 = 18,000 cfm.

Conclusions

1. A procedure and the necessary data for the calculation of infiltration through entrances of tall buildings are presented in the paper. An approximate general equation for the calculation of infiltration will also be given in Appendix E.

2. The most important variables determining the infiltration rate through building entrances are (*a*) building height, (*b*) indoor-outdoor temperature difference, (*c*) the quantity of air supplied and/or exhausted, (*d*) traffic rate, and (*e*) type of building entrance.

3. The infiltration through a vestibule-type entrance varies from about 50 to 60 per cent of that for a single-bank entrance, depending upon the traffic rate.

4. Wind velocity is not an important factor in determining entrance infiltration.

5. Entrance infiltration is not appreciably affected by the depth of the vestibule or the presence of a marquee.

6. It is only during periods of very low traffic rate that the infiltration through cracks around the doors becomes an appreciable part of the total infiltration. During periods of normal or high traffic rates, infiltration through door cracks may be neglected without serious error.

7. The approximate entrance infiltration in a 30-story building at a temperature differential of 75 F is as follows:

For single-bank door entrances — 900 cu ft per person per passage.

For vestibule-type entrances — 550 cu ft per person per passage.

A net air supply of ½ air change per hour, and a traffic rate of 500 persons per (hour) (door), were assumed in arriving at these values.

Acknowledgments

The author wishes to express his sincere thanks to the following: To Professors Alfred Koestel and G. L. Tuve of Case Institute of Technology for their helpful suggestions. To The Sanborn Co., International Steel Co., and Decker Aviation Corp. for lending instruments which greatly facilitated the collection of data. To the owners, managers, and engineers of the following *buildings*, for their helpful cooperation in the field-testing phases of the program, located in:

Pittsburgh: Grant, Koppers, U. S. Steel, Oliver, Alcoa, Gateway Center, Gulf and the Cathedral of Learning at University of Pittsburgh.

Cleveland: Fenn Tower at Fenn College, Leader, Midland, Republic, Guildhall, Standard, Schofield, Terminal Tower, The May Co., Cuyahoga Savings, Standard Drug Co., Sterling Lindner Davis, The Capital Bank, The Bailey Co., and Halle Brothers.

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URDAHL SPEAKS BEFORE BRITISH SOCIETY

Acting as the official representative of the Society at a sessional meeting of the *Institution of Heating and Ventilating Engineers of Great Britain*, T. H. Urdahl, Washington, D. C., presented the greetings of Pres. P. B. Gordon, New York, N. Y., to that group.

He also presented a paper entitled *Climatic Influences as a Basic Concept in Air Conditioning*. Mr. Urdahl's presentation brought forth a considerable amount of discussion. His paper in full together with discussions appears in the November 1957 issue of the Journal of the Institution.

HESS HEADS WESTERN ASSOCIATION

A. J. Hess, first vice president of the Society, is the newly-elected president of the *Western Air Conditioning Industries Association.*

KAYAN HONORARY CHAIRMAN AT AUTOMATION EXHIBIT

Carl F. Kayan, head of the mechanical engineering department, Columbia University, who is active in Society affairs, is acting as honorary chairman of the International Automation Exposition and Congress being held in the early part of June 1958 at the Coliseum in New York.

WEBSTER ON BOARD OF *BETTER HEATING-COOLING COUNCIL*

Warren Webster, president and general manager of Warren Webster & Co. (Society member since 1932) has been elected to the Board of Directors of the *Better Heating-Cooling Council*. Mr. Webster is also a member of the Executive Committee of *I=B=R*.

Corrosion Inhibition on Tubes in Low-Pressure Steel Boilers

By W. A. Keilbaugh* and F. J. Pocock**, Alliance, Ohio

SUMMARY: This report describes the progress made on a test program to investigate methods of alleviating water side corrosion in low pressure steel fire tube boilers. Testing techniques and apparatus are described. The general approach has been the utilization of chemical inhibitors and results indicate 2 of the inhibitors so far tested are effective in this application. Electric resistance welded steel tubing was used. All tests except one were made using plain carbon steel material. One high strength, low alloy steel was tested.

Work is continuing with particular respect to the influence of water hardness constituents on inhibitor effectiveness. One other low alloy steel is also under test. Attention is also being given to boiler storage problems.

THERE HAS been an increasing number of low pressure steel boilers installed in homes, apartments, hospitals, and similar buildings during recent years. Coincidental with this increase in the number of boilers installed, there has been an increase in reported tube failures attributed to waterside corrosion.

Under the direction of the Engineering Committee of the *Steel Boiler Institute*, a program is being carried out to investigate causes and prevention of corrosion in these units. It is hoped that the control methods developed by this investigation will, if practiced, lead to the practical elimination of corrosion difficulties and further strengthen the position of steel boilers in a field where they are already accepted as durable, economical heat producers.

Discussions with the Engineering Committee of the *SBI* prior to the beginning of investigation indicated that the principal cause of the corrosion difficulties was the unavoidable presence of oxygen in the feedwater and boiler water. Since deaeration of the feedwater is not practical or the addition of chemical oxygen scavengers is not generally feasible from a control standpoint in these low-pressure steel boilers, other methods of approach to the oxygen corrosion problem were considered. There appeared to be two major possible modes of attack: (1) Use of chemical inhibitors whose operating mechanism does not rely upon reaction with oxygen. It was obvious that chemical consumption by oxygen, with the consequent necessity of short interval chemical replenishment, would be an intolerable inconvenience for most boiler owners. (2) Use of corrosion resistant materials consistent with the economics of the cost of low-pressure fire tube boilers.

A major consideration in the stated approach to the problem was the requirement that if chemical inhibition were to be used, the method of inhibition should not require the services of a skilled water-treatment service engineer.

It has been apparent that corrosion testing involving the use of coupon material in laboratory bench scale tests or in autoclaves does not afford conditions comparable to the actual operation of a boiler, since temperature, heat transfer and operating conditions are different.

For this reason, the Engineering Committee of *SBI* decided to study the problem of tube corrosion in laboratory operation of test boilers under conditions as close as possible to those found in actual field units.

Since *SBI* and the authors' company have a common interest in this area, the research facilities of the company were offered for the purpose of carrying out the investigation. The *SBI* accepted this offer with the stipulation that test conditions and operating procedure be subject to approval by their Engineering Committee. The program herein described was started in the latter part of 1954 and this report is a record of progress from test inception to April 1957.

Boiler Design

The test equipment provided by the *SBI* for this investigation consists of 4 gas-fired steel boilers, each of which has its own feedwater and condensate system.

Each unit contains, except as noted later, four 3-in. OD by 48-in. long electric resistance welded boiler tubes made to *ASTM*-A-178 Grade A specifications which are rolled into $\frac{3}{8}$-in. carbon steel tube sheets. Each boiler is fired with a conventional 120,000 Btu per hr gas burner.

The units operate at essentially atmospheric boiling conditions. The steam is condensed and the condensate is passed counter-currently to air flow through a baffled aerating

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For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 1958.

tower. The air saturated feedwater is then fed automatically to the boiler as required by the boiler water level controls. Total steam flow for each unit is approximately 50 lb per hr. Steam losses are made up automatically from aluminum storage tanks containing distilled water. Using distilled water as a starting point, water chemical characteristics can be varied as desired.

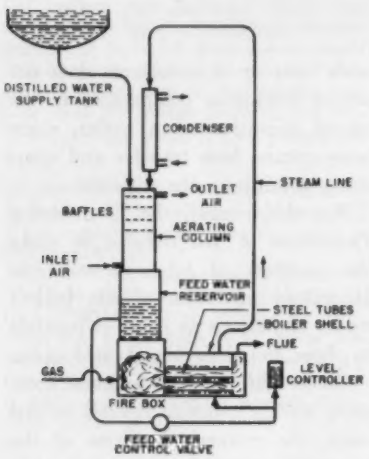


Fig. 1 — Schematic diagram of the test unit

Automatic timing controls are provided so that the boilers are operated in pairs for 30-min firing intervals with an equivalent *off* period. This condition was chosen to simulate as closely as possible the periodic operation of the usual heating boiler.

The boilers are operated 24 hr a day in this manner for the duration of each test.

Fig. 1 shows a schematic drawing of a typical test unit. Fig. 2 shows a general view of the test installation.

Boiler Tubes

Boiler tubes used thus far in the investigation have been electric resistance welded boiler tubes made to *ASTM*-A-178 Grade A specifications except in 1 case. One test was operated using high strength, low alloy steel tubes. The tubes are supplied in 6-ft lengths and are cut to the 4-ft length required for the test boilers. As received, the tubes have a thin film of soluble oil as corrosion protection in transit.

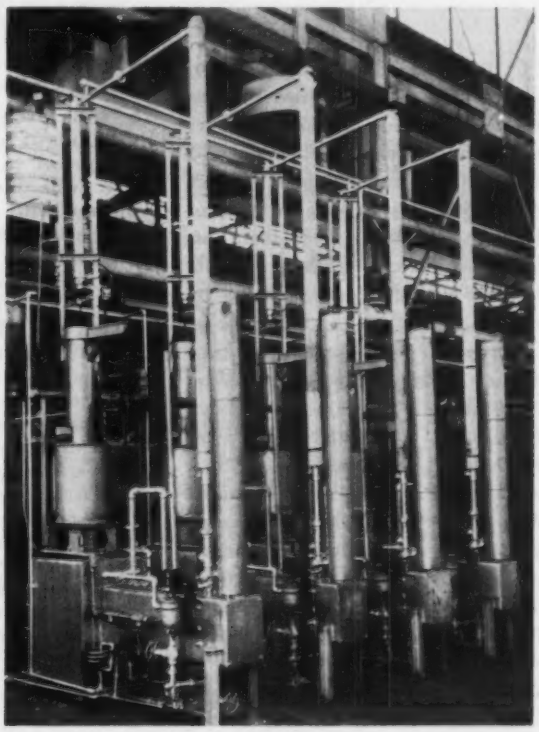


Fig. 2 — General view of test installation

The tubes are rolled into the test boilers in the *as received* condition except for light wiping with cloth and mineral spirits to remove foreign material which is picked up in shipment and some of the oil.

The tubes used in these tests were not acid cleaned (*i.e.*, pickled).

Chemical Composition of the Boiler Tubes: Representative tubes from each steel heat used in this investigation were analyzed chemically. Analyses of the type A plain carbon steel tubes and the high strength, low alloy steel tubes are contained in Table 1.

Table 1 — Tube metal analyses

Test No.	1 &5	2	3	4	6	7, 11 & 15	8	9 & 10	12	13[b]	14 & 16
	Percent										
Carbon	0.17	0.12	0.12	0.10	0.11	0.17	0.07	0.08	0.12	0.08	0.15
Silicon	0.01	0.01	0.015	0.01	0.01	0.01	0.01	0.01	0.01	0.36	0.01
Manganese	0.35	0.35	0.34	0.34	0.41	0.38	0.38	0.34	0.43	0.29	0.44
Phosphorus	0.008	0.008	0.010	0.010	0.008	0.013	0.007	0.010	0.010	0.089	0.01
Sulfur	0.023	0.019	0.021	0.016	0.029	0.037	0.017	0.04	0.05	0.039	0.029
Nickel[a]	0.059	0.054	0.043	0.045	0.13	0.13	0.13	0.058	0.050	0.28	0.052
Chromium[a]	0.056	0.052	0.051	0.050	0.05	0.06	0.05	N.D.[c]	N.D.[c]	0.69	0.05
Vanadium[a]	0.005	0.005	0.005	—	—	—	—	—	—	—	—
Molybdenum[a]	0.008	0.008	0.008	0.008	0.03	0.02	0.03	0.01	0.005	0.008	0.009
Copper[a]	0.06	0.07	0.08	0.07	0.06	0.06	0.06	0.046	0.064	0.30	0.07
Aluminum[a]	0.005	0.005	0.005	0.005	..	..	..	0.001	0.002	0.005	0.004
Tin[a]	0.006	0.008	0.007	0.007	0.009	0.007	0.008	..	..	..	..

[a]Spectrographic Trace Metal Analyses.
[b]High Strength, Low Alloy Steel.
[c]N.D. = Not Detected.

Base Boiler Waters

Owing to the wide variations that occur in natural water supplies, it was agreed that the make-up water

would be laboratory distilled water. Except for the initial test, the test solution in contact with the boiler tubes consisted of oxygen saturated distilled water containing 100 ppm chloride as sodium chloride. Sodium chloride was not added to the test solution during the first test period.

The corrosive attack suffered by the boiler tubes in this base boiler water is shown in Figs. 3 and 4.

Inhibitors

To date, 4 inhibitors have been used in various test periods. They are as follows: (1) *A Buffered Chromate Compound.* This inhibitor is marketed under the auspices of the *SBI.* (2) *Borate-Nitrate-Nitrite Compound.* This inhibitor is a proprietary chemical compound distributed by a water treatment company for the express purpose of corrosion inhibition in diesel engine cooling systems. (3) *Sodium Molybdate.* This material was tested on the basis of the reported work of others.† The material used was reagent grade sodium molybdate meeting *ACS* (*American Chemical Society*) specifications. (4) *Sodium Hydroxide.* Sodium hydroxide added in a concentration sufficient to produce a pH of 11.0 was used in 1 test. The sodium hydroxide used was reagent grade meeting *ACS* specifications.

Testing Technique

Start-up for the tests consisted of installing new tubes, as required by individual test series and as previously described, followed by a short boil out with 0.3 percent sodium hydroxide solution to remove residual oil. Following the boil out, the boilers were drained and rinsed with zeolite treated water. After the treated water rinse each boiler was rinsed with distilled water, drained, and refilled with the test boiler water. Samples of the new tubing installed in the boilers were analyzed chemically.

Table 2 — Summary of test conditions

Test Solution Boiler Water No.	Test No.	Time Tubes Immersed in Boiler Water, Hours: Operating[a]	Time Tubes Immersed in Boiler Water, Hours: Down-Time	Type Tubes	Tube Condition	Inhibitors[d]
1[b]	1	3307	1656	E.R.W. *ASTM*-A-178 Grade A Boiler Tubes	NEW	NONE
	2	3307	1656	"	NEW	No inhibition initially followed by inhibitor A
	3	3307	1656	"	NEW	Inhibitor B
	4	3338	1625	"	NEW	Inhibitor A
2[c]	5	3148	788	"	Same as Test #1	Continued in test with addition inhibitor A
	6	3148	788	"	NEW	No inhibition initially, followed by inhibitor B
	7	3148	788	"	NEW	Inhibitor B
	8	3148	788	"	NEW	Inhibitor A
	9	2615	865	"	NEW	Inhibitor C
	10	2615	865	"	NEW	Inhibitor D
	11	2615	865	"	Same as Test #7	Inhibitor B
	12	2615	865	"	NEW	NONE — Tubes painted and paint spattered
	13	2548	1388	E.R.W. High strength low alloy	NEW	NONE
	14	2548	1388	E.R.W. *ASTM*-A-178 Grade A	NEW	No inhibition copper tankless heating coil installed
	15	2548	1388	"	Same as Test #7	Inhibitor B
	16	2548	1388	"	NEW	No inhibition, physio-chemical water conditioner

[a]Operating time refers to actual cyclic firing of the boilers as described elsewhere. Down-time is due to inspections, routine maintenance and mechanical failures.
[b]Boiler water No. 1 is air saturated distilled water.
[c]Boiler water No. 2 is air saturated distilled water with 100 ppm chloride.
[d]Inhibitor code: (A) Buffered chromate. (B) Borate-nitrate-nitrite. (C) Sodium molybdate. (D) Sodium hydroxide.

†Molybdate and Tungstate as Corrosion Inhibitors and the Mechanisms of Inhibition, by W. D. Robertson (*Journal of the Electrochemical Society*, Vol. 98, No. 3, 1951).

Table 3 — Summary of test results

Type Inhibitor[a]	Test No.	Inhibitor Concentration ppm (average)	pH Average	Chloride as ppm Cl (average)	Dissolved Oxygen Conc. MLS Liter Average	Deepest Pit Measured, Inches	Number of Pits per Lineal Foot	Comments
NONE	1	..	7.6	Not Added	5.2	0.015	3300	Generalized pitting attack
A	2	2116	10.5[b]	"	5.4	0.01	840	Corrosion halted
B	3	7281	9.1	"	[c]		No Pitting	No corrosion
A	4	1860	9.8	"	5.3	0.01	25	Slight corrosion[d]
A	5	1904	10.9	99	4.9	0.016	Note (1)[e]	Corrosion halted
B	6	7183	9.5[b]	100	5.1	0.008	Note (2)[e]	Corrosion stifled
B	7	6318	9.1	99	[c]		No Pitting	No corrosion
A	8	2000	9.3	109	5.0		No Pitting	No corrosion
C	9	1978	10.5[b]	98	4.5	0.005		Some inhibition of further corrosion
D	10	..	11.0[b]	90	4.7	0.014	Note (3)[e]	Corrosion not halted
B	11	4000	9.1	92	[c]		No Pitting	No corrosion. Concentration lowered gradually
NONE (painted)	12	..	7.6	102	4.8	Etched Appearance	Not Counted	Corrosion accelerated
NONE (high str. steel)	13	..	10.0	95	5.1	0.003	615	Generalized surface brightening with slight attack
NONE (copper coil)	14	..	10.4	89	5.3	0.011	2770	Did not appear to localize or accelerate attack
B	15	2500	9.2	97	5.5		No Pitting	No corrosion. Concentration lowered gradually
NONE (Physio-chemical device)	16	..	10.1	94	4.8	0.020	2940	Did not prevent corrosion

[a]See Table 2 for inhibitor code.
[b]Average pH value after addition of the respective inhibitors.
[c]Excessive carryover experienced with Borate-nitrate-nitrite inhibitor at these concentrations prevented the chemical determination of the dissolved oxygen in the feedwater.
[d]The slight corrosion noted on these tubes is attributed to an initially low chromate concentration. Also, this boiler was used for control adjustment during shakedown period.
[e]Notes (1) No increase in incidence of pitting. (2) Compared photographically with earlier inspection. (3) Deep pits overlayed with carbuncles.

An operating log was maintained for routine maintenance and recording of gas pressure, cooling water pressure, boiler water level, and water analyses.

Samples of the boiler water were taken twice weekly for analysis. Usual analyses consisted of pH, chloride, conductivity and inhibitor concentrations (when used). Periodically the feedwater was analyzed for dissolved oxygen and evidences of carryover.

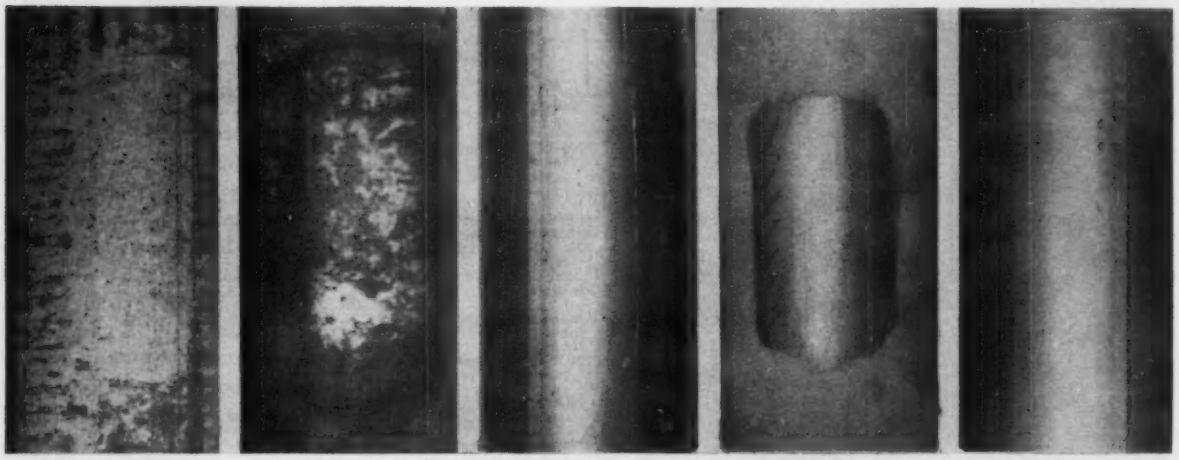
Each set of waterside conditions was tested for approximately 6 months. One unit was operated with uninhibited oxygenated-distilled water in an early test period to serve as a blank for comparison with the tubes from boilers to which inhibitors were added. The test conditions and test numbers are shown in Tables 2 and 3.

Water Samples: Boiler water samples were taken through a cooling coil from the bottom of the boiler. Feedwater samples were taken from the main feedwater line leading to the feedwater control valve. A cooling water coil was installed on the feedwater sampling line, principally for the dissolved oxygen sampling, since condensate temperatures averaged 100 F and standard dissolved oxygen analytical methods dictate a sample temperature of 65 ± 5 F.

Methods of Water Analysis: pH measurements were made with a Model H-2 pH-meter incorporating a glass-calomel electrode pair. Chloride was determined by the Mohr titration method. Special techniques for chloride analysis in waters containing the borate-nitrate-nitrite material were required. Water in this case was treated with activated charcoal to remove the organic matter, followed by pH adjustment and the usual Mohr titration for chlorides. Conductivity measurements were made with a commercial conductivity bridge using a glass *dip type* conductivity cell. Standard curves plotting chloride and chromate, chloride and borate-nitrate-nitrite, or chloride and sodium molybdate *vs* conductivity were made to maintain control concentrations of the various inhibitors. Sodium hydroxide determinations were made by *ASTM* method D-514-17 (acidimetric).

Dissolved oxygen was determined by the conventional Winkler procedure, the usual precautions being taken to avoid air contact with the sample. The dissolved oxygen concentration of the feedwater varied from 4.6 milliliters per liter to 5.0 milliliters per liter for the duration of each test. This value corresponds to 90-100 percent saturation of a 100 F feedwater with air.

Corrosion Measurement: The corrosion pit depths were measured microscopically and the number of pits per unit of metal surface area were counted where possible. Microscopic examination of the tubing in place in the boilers consisted of taking a clay impression of the deepest visible pits and then measuring the height of the nodule formed on the clay block. The curved surface of the tube makes other methods extremely difficult. Data taken on the removed



Test No. 1-3307 hr oxygenated distilled water. Heavy generalized corrosive attack.

Test No. 2-3307 hr oxygenated distilled water. Buffered chromate added after initial corroding period. Corrosion halted.

Test No. 8-3148 hr oxygenated-chloride distilled water. Buffered chromate for duration of test. No corrosion.

Test No. 3-3307 hr oxygenated-distilled water. Borate-nitrate-nitrite concentration 7500 ppm. No corrosion.

Test Nos. 7, 11, 15-8311 hr oxygenated-chloride distilled water. Borate-nitrate-nitrite concentration reduced from 7500 ppm to 2500 ppm. No corrosion.

Note: Hours reported here do not include downtime (see Table 1)

Fig. 3 — Photographs of tubes after test (½ diam)

tubes were obtained by direct measurement of the pit depth with a microscope calibrated for this purpose. Photographic evidence was also employed for comparisons between tubes.

Discussion

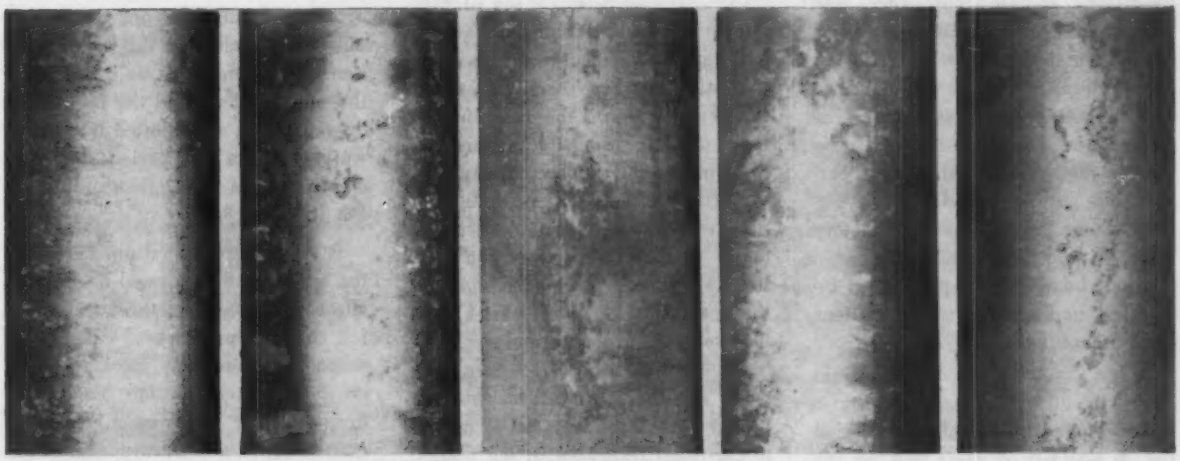
Figs. 3 and 4 show graphically the effect of oxygen on boiler tubes in these tests. The tubes operated for 3307 hours (Test No. 1) in uninhibited boiler water show heavy generalized corrosion resulting from dissolved oxygen attack. Field observations have shown the 2 types of corrosion that may be experienced. One type is highly localized and intense, while the other is generalized and widespread. The second type of corrosion is less serious since the life expectancy of a boiler tube can only be gaged by the deepest pit. It was hoped that during the testing reported here, that some localized and intense pitting might occur under laboratory controlled conditions so that differentiation between the conditions causing both types of corrosion might be ascertained. Unfortunately, in the testing so far completed, no such occurrence has taken place. The corrosion experienced has been general and widespread and selective corrosion reportedly occurring in some cases as a single pit on a tube or at the tube and tube-sheet junction did not occur.

It is postulated that localized intense pits have their inception at periods of boiler storage or in areas where circulation velocities are low and localized stagnation may occur. Conditions such as these would lead to the formation of highly concentrated differential aeration corrosion cells which are well known and which have been noted many times in improperly stored industrial and power plant units.

The reference to the addition of an inhibitor after an initial corroding period refers to the fact that it was desired to obtain a proven inhibitor which could be added to existing heating boilers, many of which had already suffered some oxygen pitting. If the inhibitor was unsuccessful in halting corrosion once initiated under test conditions, then its value in existing installations would be questionable. For this reason, all the inhibitors used were subjected to this operation.

The borate-nitrate-nitrite (Tests 7, 11 and 15) inhibitor was first used at an extremely high concentration of 7500 ppm. At this concentration considerable foaming and carryover were experienced. Subsequently the inhibitor concentration was reduced in a step-wise manner over an 18-month period to test its effectiveness at lower concentrations. Below 3000 ppm, carryover was not detected in this test equipment and the tubes still showed no corrosion or incipient pitting.

Early tests with the buffered chromate inhibitor (No. 4) at concentrations of the order of 1500 ppm showed a few incipient pits. This test unit had been used to establish control settings on the test installation and the exact cause of the observed pitting was unknown. However, based on previous experience with chromate inhibitors in other applications, it was decided to use a level of 2000



Test No. 9-2615 hr oxygenated-chloride distilled water. Sodium molybdate added after initial corroding period. Corrosion not stopped.

Test No. 10-2675 hr oxygenated-chloride distilled water. Sodium hydroxide added after initial corroding period. Corrosion not stopped.

Test No. 14-2548 hr oxygenated-chloride distilled water. Copper stainless heating coil in contact with boiler water. Corrosion not accelerated.

Test No. 13-2548 hr oxygenated-chloride distilled water. High strength, low alloy steel tubing installed. Mild surface corrosion.

Test No. 16-2548 hr oxygenated-chloride distilled water. Physio-chemical feedwater conditioner installed. Widespread corrosion.

Note: Hours reported here do not include downtime (see Table 1)

Fig. 4 — Photographs of tubes after test (½ diam)

ppm for further testing (No. 8). No carryover was experienced with the chromate inhibitor at this concentration level and there was no corrosion. The results of this investigation are graphically shown in Fig. 3.

Sodium molybdate (Test No. 9) was tried as an inhibitor based on bench scale testing reported in the literature.† This work indicated successful inhibition with the following chemicals: sodium molybdate, sodium tungstate, sodium chromate, and sodium nitrite. Coupon type bench tests in the laboratory screening work with sodium molybdate at a temperature of 200 F in air saturated solution showed good results. It was agreed that this test should be carried out in the model boilers. Results of one test were not satisfactory (Fig. 4) and the application of sodium molybdate for the purpose of inhibition under these test conditions was discontinued.

A test involving the use of sodium hydroxide (No. 10) to produce a boiler water pH of 11.0 was carried out. It was felt by some that the use of sodium hydroxide at a pH of 11.0 would be sufficient to deter further heavy corrosion. The results are shown in Fig. 4. It is evident that sodium hydroxide alone is not sufficient. While the severity of the oxygen attack may be diminished through increased pH, this type of approach is not an effective means of protection.

In order to illustrate that the inadvertent contamination of boiler tube surfaces by paint during boiler manufacture has a deleterious effect on operational tube life, one test (No. 12) involving this consideration was carried out.

Two of the tubes in this test had their entire waterside surface covered with a typical paint used for external boiler protection. Two other tubes were simply spattered with aluminum paint. These tubes were operated in uninhibited boiler water. The results of this test showed that corrosion was accelerated by the paint contamination.

Low alloy steels have been considered for use in low pressure steel boilers. It was stipulated however, that the material used be consistent with the economics of the cost of low pressure steel tube boilers. One test (No. 13) involving the use of high strength, low alloy tubing in chloride oxygenated distilled water without inhibition has been carried out thus far. Fig. 4 shows the condition of this tubing after test. Pits were few in number and shallow; the type of attack was general in nature and not so severe as has been observed in other cases with plain carbon steel tubes. It should be pointed out that the analysis of this steel varies from heat to heat, probably more so than plain carbon steel. However, the work of others‡ indicated that the copper content of the steel is related to corrosion resistance in sea waters. These investigators also illustrated that this same condition does not appear to hold true at higher alkalinities. Also, apparently above about 0.2 percent copper, no additional advantage is gained.

With the thought that copper, a dissimilar metal, might adversely affect tube corrosion resistance, an investigation was made of the influence of a copper tankless heating coil installed in contact with the boiler water (Test No. 14). The total surface area of the copper tankless heating coil immersed in the boiler water was approximately 3 percent of the ferrous boiler surfaces in contact with the boiler water. This test was carried out with plain carbon steel tubing in uninhibited base boiler water. The results shown in Fig. 4 reflect the examination of these tubes which showed no localization or acceleration of corrosion during the test period.

In view of widespread attempts to sell physio-chemical water conditioning devices to the industry, it was decided to test one of these units (Test No. 16).

The water conditioning device used was of a type that is installed on the boiler feedline with normal piping connections. No power source or other connections are used. This unit was installed on the boiler feedline under conditions as directed by the manufacturer and the boiler was operated with uninhibited test boiler water for one test period. For this single test the device was unsuccessful. (See Fig. 4).

It should be pointed out here that the tests so far performed neglect the effect of hardness in the water. It is felt that the presence of calcium or magnesium ions may have an effect on the required inhibitor concentrations and for this reason, tests are now in operation incorporating the addition of hardness to the boiler water.

Field experiences in the boiler industry have indicated that boiler storage conditions are closely related to extensive corrosive damage involving boiler tubes. It has been found that some localized corrosion has its inception during periods of lay-up and extensive downtime when the boiler is wet or contains a moist atmosphere. Accordingly, tests are being carried out under static conditions to investigate corrosion during storage and the efficiency of inhibitors in preventing attack during these periods. In these tests, small carbon steel boxes have been constructed with simulated tube sheets forming two of the sides. Plain carbon steel tubes were rolled into the tube sheets and these boxes have been laid up at atmospheric conditions for 3-month intervals. These tests are incomplete at this time.

†Molybdate and Tungstate as Corrosion Inhibitors and the Mechanisms of Inhibition, by W. D. Robertson (*Journal of the Electrochemical Society*, Vol. 98, No. 3, 1951).

‡Model Boiler Tests on the Influence of the Copper Content of the Steel on the Corrosion of Tubes in Artificial Sea Water, by G. M. A. Butler and H. C. K. Ison (*The Institute of Marine Engineers*, February 12, 1957).

Conclusions

It is readily apparent that dissolved oxygen will cause immediate and widespread corrosive attack under these test conditions. This attack is best explained by the electrochemical theory of corrosion and is well documented.

Testing apparatus and technique have been developed which more nearly duplicate operating conditions for low pressure heating boilers than do bench type coupon or autoclave types of corrosion and inhibitor investigations.

Test operation to date has produced the following conclusive results for the previously described test conditions.

1. The buffered chromate type inhibitor is effective in halting and preventing corrosion caused by dissolved oxygen under operating test conditions. The minimum effective inhibitor concentration appears to be 2000 ppm.

2. The borate-nitrate-nitrite inhibitor is effective in preventing corrosion caused by dissolved oxygen under these test conditions. The minimum concentration appears to be 3000 ppm. At this concentration, carryover is not observed in the test equipment.

3. Sodium molybdate and sodium hydroxide are not effective in halting dissolved oxygen attack in the test boilers.

4. The immersion of a copper tankless heating coil in the boiler water, out of contact with the tubes, does not accelerate or localize corrosive attack under these test conditions.

5. The physio-chemical feedwater conditioner used in this test program was ineffective in preventing or reducing corrosive attack by dissolved oxygen.

6. One test with high strength, low alloy steel tubing indicated a less severe attack than was observed on carbon steel tubing under the same test conditions. Some attack was noted but the pits were shallower and the incidence of pitting was lower.

Present and Future Activity

At present, the buffered chromate and the borate-nitrate-nitrite inhibitors are being investigated in the presence of calcium hardness in the water. It is probable that magnesium hardness will also be included at a later date. One other high strength low alloy steel is under test and investigation of influence of boiler storage conditions is continuing.

It is believed that it should be possible in the not too distant future for the *SBI* to originate a revised set of instructions for the care of the water side of the low pressure units.

Acknowledgments

This research is being carried out by the Research and Development Center of the Babcock & Wilcox Co., Tubular Products Division, for the *Steel Boiler Institute.*

The guidance of the Engineering Committee of *SBI* continues to be of utmost importance in furthering the objectives of the test program.

The consultation and help given to the writers by H. F. Hinst, chief metallurgist, Tubular Products Division, Babcock & Wilcox Co., is also gratefully acknowledged.

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Corrosion in Scotch Marine Boilers, Part I, by F. D. Wormell, G. M. A. Butler, and J. G. Beynon (*The Institute of Marine Engineers Transactions*, Vol. 69, April 1957, p. 109).

PRIZE-WINNING SOLAR HOUSE

It has been announced that the prize-winning solar house, the design of which brought an award to P. R. Lee, senior student in architecture at the University of Minnesota, will be built near Scottsdale, Ariz. during 1958.

The contest was sponsored by the *Association for Applied Solar Energy*. The house is designed with solar collectors for heating, for heating domestic water, and for heating the water for a swimming pool.

SOCIETY MEMBERS PROMOTED IN M-H ORGANIZATION

Among various changes made in the commercial division of Minneapolis-Honeywell Regulator Co., as announced by John E. Haines, company vice president and past president of the Society, was the reassignment of several Society members.

L. B. Belford was appointed to the newly-created post of eastern regional commercial sales manager. J. H. Jester became northwest regional sales manager in Minneapolis. R. L. Patton was named regional sales manager for the seven-state Mountain region with headquarters in Denver.

WILLIAMS AND SPANGLER PROMOTED AT NATIONAL-U. S.

Two Society members, H. Wells Williams and E. S. Spangler have been promoted in the organization of National-U. S. Radiator Corp.

The promotions were announced by L. N. Hunter, senior vice president of National-U. S. and past president of the Society. Mr. Williams becomes consultant for the engineering and research department and Mr. Spangler is made manager of heating elements engineering.

WALLACE MADE AMERICAN STANDARD SM AT SALT LAKE

J. W. Wallace, Jr., who joined the Society in 1948, was recently made sales manager of American Standard at Salt Lake City, Utah.

NEW SECRETARY FOR *ASME*

In December, the Council of *ASME* elected O. B. Schier, II, as secretary. Mr. Schier takes up the duties of secretary following the retirement of C. E. Davies who has been secretary for the past 23 years and who has been in the service of *ASME* for nearly 33 years.

Colonel Davies will continue to serve the engineering profession as coordinator for the United Engineering Center, plans for which have been completed and real estate acquired. ASHAE has announced its intention of occupying office space in the new UEC when completed.

CHERNE IS DIRECTOR OF CONSULTING ENGINEERS

R. E. Cherne, a member of the Society, has been made a director of the *New York State Association of Consulting Engineers, Inc.*, with headquarters in Syracuse, N. Y.

Mr. Cherne is also currently serving on the Guide Advisory Committee of the Society.

ASHAE Semi-Annual Meeting in Minneapolis, June 23-25

The Semi-Annual Meeting of the Society will take place June 23-25, 1958 in the Nicollet Hotel, Minneapolis, Minn., as announced by Pres. E. R. Queer, University Park, Pa.

Simultaneously the 54th Annual Meeting of the *American Society of Refrigerating Engineers* will be held in Minneapolis, with headquarters in the Leamington Hotel. The ASHAE and the *ASRE* Committees on Arrangements, comprised of members of the ASHAE Minnesota Chapter and the *ASRE* Twin Cities Section, have cooperated in the planning of various joint special events.

Both Societies are arranging their sessions so that it will be possible to extend an invitation for the members and guests of both organizations to attend one or more of each other's sessions.

The general chairman of the ASHAE Minnesota Chapter Committee on Arrangements is J. S. Locke, with G. M. Kendrick and J. F. Siegel as co-chairmen. The *ASRE* Twin Cities Section general chairman is V. D. Wissmiller.

Tentatively the respective Committees on Arrangements are scheduling several joint functions. On Sunday evening, June 22, there will be an informal party sponsored by *ASRE*, with an invitation extended to all ASHAE members. Monday evening, June 23, there will be a get-together sponsored by ASHAE, with an invitation extended to all *ASRE* members.

Separate Welcome Luncheons will be held by each Society on Monday, June 23, but on Tuesday evening, June 24, the Banquet will be a jointly arranged affair with members of both organizations attending.

Inspection trips, tours, ladies' events, and children's activities will be worked out cooperatively wherever possible, and where separate events are planned by each Society, invitations will be extended to the other.

The ASHAE Semi-Annual Meeting will consist of 5 Sessions during which 9 papers and 2 symposiums will be presented. It is planned to have 1 session Monday morning, and 1 on Wednesday morning, with the final session on Wednesday afternoon.

The first symposium will be on the subject of thermal insulation and the symposium manager is W. M. Keyes, Pittsburgh, Pa. Those participating in this symposium will discuss reflective and bulk insulation, block and pipe insulation, vapor problems in thermal insulation, thermal insulation for nuclear systems, surfacings for glass fiber, and foam thermal insulation.

The second symposium, with 1st Vice Pres. A. J. Hess, Los Angeles, Calif., as the symposium manager, will deal with condensing methods, including cooling tower design and performance, evaporative condensers, air-cooled condensers and an economic evaluation of condensing methods.

The 9 papers will cover a variety of topics of timely interest, among which are a study of infiltration through building entrances, shading effects of canvas awnings, and a report on solar energy utilization.

HV&AC Design Practice for Schools

By

Henry Wright

The author is Director, Building Product Research, Siles Snider Assoc., Inc., New York, N.Y. A presentation at the Symposium on School Heating, Ventilating and Air Conditioning at the 64th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Pittsburgh, Pa., January 29, 1958.

AS LONG AS 20 years ago, it was recognized by heating and ventilating engineers that the school classroom constitutes a unique problem in ventilation, heating and cooling. The typical school classroom is used in the middle of the day when outside temperatures are rising. It is a densely occupied space with large window areas that frequently admit huge quantities of solar heat, and it has a high artificial lighting load. .

Twenty years ago it came to be understood that, for these reasons, to prevent overheating of school classrooms large quantities of cool outdoor air were frequently needed. Classroom ventilation came to be recognized as primarily a cooling problem, and it was realized that school ventilation divided itself into 2 distinct functions:

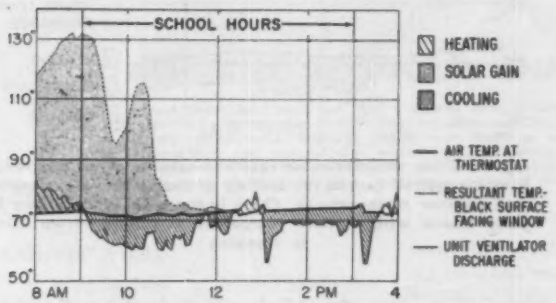

Fig. 1—Cooling indicated by lower shaded area was required in east classroom most of school day. Room temperature was held between 71 and 73 F except for momentary peak when class returned following lunch period. Outdoor temperature 10 F to freezing

1. *Minimum ventilation*, by which is meant the admission of sufficient outdoor air to dilute odors to an acceptable level and control indoor relative humidity—usually around 10 cfm per pupil.

2. *Variable ventilation* for classroom cooling.

In recent years, the writer has had the opportunity to conduct a number of detailed performance studies of classroom heating and ventilating equipment which have abundantly demonstrated the need for wintertime classroom cooling. In one of the several schools studied, for example, it was found necessary to introduce over 1000 cfm of 65 F air into a west-facing schoolroom when the outdoor temperature was only 12 F. In other cases, even more extreme, such cooling has been found necessary at an outside temperature of zero.

The accompanying Figs. 1 to 4, represent records of the classroom cooling problem in identical rooms facing east, west, north and south, in a school in Moline, Ill., where tests of the type mentioned were conducted.

Fig. 1 shows the conditions for a March day in an east-facing classroom, between the hours of 8 a.m. and 4 p.m., with outdoor temperatures ranging from 10 F to freezing. Between 8 and 9 a.m., as indicated by the cross-hatched area at the left, the unit ventilator discharge temperature was above the room temperature and heat was being supplied to the room. From 9 a.m. on, as indicated by the cross-hatched area under the room temperature line, the discharge by the ventilator was below room temperature, which was thus providing cooling. At 12:30, however, the absence of pupils from the room and the cessation of solar gain, represented by the cross-hatched area above the room temperature line, resulted in a ½-hr period of heating—a nice demonstration of the influence of the *pupil heat load* which has cropped up in many such tests. From 1 p.m. until the end of the school day, cooling, as indicated by the cross-hatched area at the right, was again needed, but at a lesser rate than during the morning.

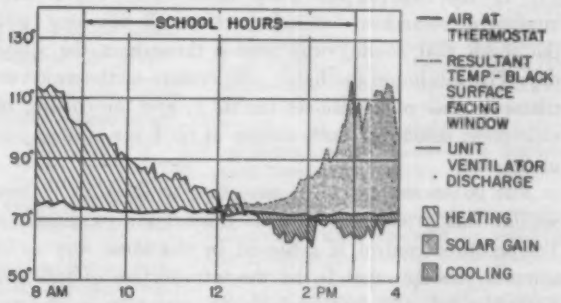

Fig. 2—Heating indicated by left shaded area was noted in west classroom until end of lunch period. During the afternoon solar gain through west windows necessitated cooling despite freezing weather

Fig. 2 shows the conditions present in a west-facing classroom, where, owing to the absence of solar gain in the morning, heating was required until noon, and then a small additional amount of heating, owing to the absence

of the pupils for lunch. Solar gain during the afternoon was not so intense as in the morning in the east classroom; nevertheless, cooling was needed all afternoon.

In the north-facing classroom shown in Fig. 3, it is not surprising that heating was needed until well into the afternoon. However, there was some recorded diffuse solar gain through the north windows, as represented by the dotted

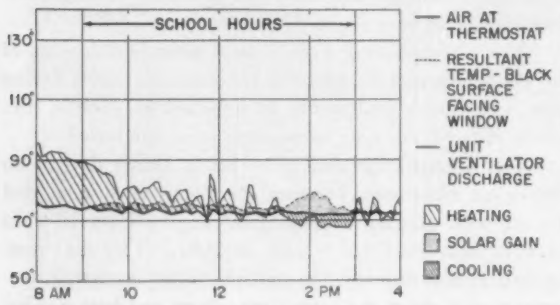

Fig. 3—North classroom which received no direct solar gain nevertheless required only moderate heating during the morning. Indirect solar gain, the result of reflection from snow-covered ground, necessitated cooling in mid-afternoon

area, and a smaller amount of necessary cooling, shown by the cross-hatched area below the room temperature line.

In the case of the south room (Fig. 4), a large amount of solar heat entered the room all day long, with the result that cooling was needed throughout the school day. The minimum discharge temperature of the unit ventilator in this room was set for 60 F, and the cooling requirement demanded introduction of 60 F air a large part of the time.

It is interesting, when one stops to think of it, how similar this problem is to conventional air conditioning, Temperature control is achieved in the same way as in summer cooling—that is, by the introduction of sufficient quantities of air cool enough to maintain a thermostatically determined temperature. Any differences between this type of ventilation and summer air conditioning tend to make wintertime ventilation cooling a more exacting comfort problem than summer air conditioning. Since maintained temperatures are generally lower, it has always been very important to avoid drafts in connection with winter cooling; such factors as cold window glass serve to complicate the draft problem further.

In other words, it happens that there is a rather large body of experience bearing on comfort cooling of school classrooms. Now that refrigeration cooling of schoolrooms in summertime is being actively considered, it is important to realize that such experience exists, and can serve as a guide to summer cooling practice. In schoolrooms, for example, it is well established that this cooling job can be done from a single discharge point, usually located in the middle of the outside wall, if the cooling air is blown upward at a high velocity and diffused over the ceiling. It is doubtful whether many air-conditioning engineers, familiar only with typical summer cooling practice, would attempt to cool so large a room as a school in this relatively simple way; and yet, there is no question that satisfactory cooling can be achieved by this means.

Another only slightly less important point is that ventilation cooling of the type used for years in school classrooms remains essential even where refrigeration cooling is provided, since the alternative would be the operation of the refrigeration plant, at times when out-

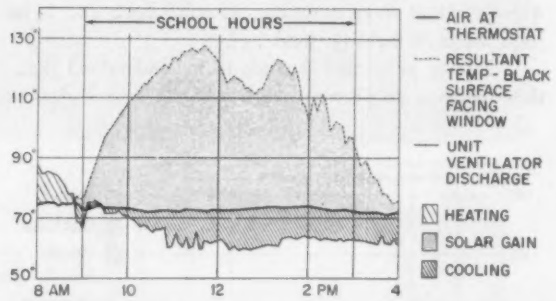

Fig. 4—Since this classroom received solar heat all day long, it also required continuous cooling at maximum rate, despite cold outdoor temperatures. Chart is for a fairly clear day in early March with outdoor temperatures ranging from 10 F to freezing

door air is available free of charge, to do the cooling job. In fact, it has been demonstrated that, even in the summertime, availability of 100 percent outdoor air for ventilation cooling can render the operation of refrigeration cooling systems much more economical through the method of *night purging* of heat accumulated in the building structure by forced circulation of outdoor air.

In other words, there is little or no conflict between the design requirements for wintertime heating and ventilation cooling in school classrooms, and summertime air conditioning. In both cases, any system should be capable of providing 5 needed features, *viz.*:

1. Fixed minimum ventilation on a per-pupil basis during periods of occupancy.
2. Quick heating effect for morning warm-up in the wintertime, and quick cooling effect in summertime.
3. Outdoor air ventilation, up to 100 percent of the system's circulating capacity, thermostatically controlled on a room-by-room basis.
4. Draft-free circulation of the maximum quantity of air in large-windowed classrooms—up to 10 or even more volumes per hr.
5. Adequate controls for night setback, and to meet other specific occupancy requirements.

In the past, one of the simplest and most convenient methods of meeting these requirements has been the unit ventilator, which has thus enjoyed deserved popularity in

the school field. Central fan systems of one or another type can be arranged to satisfy all 5 requirements, but such arrangements usually require the use of double-ducts, and/or auxiliary heating equipment within the classroom. In some cases, systems of this kind have been simplified by the device of providing a steady supply of ventilation air at some fixed temperature, such as 65 F. While this method may produce some economies in first cost, it is wasteful and not entirely satisfactory from an operational standpoint, since, on the one hand, air at this low temperature is not always needed, and, on the other hand, such air may not be cool enough to satisfy the full cooling requirement. These facts should be borne in mind in designing refrigeration cooling systems for school classrooms. A typical central fan air-conditioning system, as used in commercial buildings, is inappropriate for this purpose because of its failure to provide large quantities of outdoor air for ventilation cooling. On the other hand, unit ventilators are now available designed for summer refrigeration cooling as well as wintertime ventilation cooling and heating.

A rather simple way of analyzing the performance potential of alternative systems is to compare them with the operating characteristics of the year-round unit ventilator in the light of the 5 points previously enumerated.

The essence of good classroom ventilating technique has always been that it must provide 2-way temperature control; that is, control of the upper limit of temperature, as well as the lower, whenever sufficiently cool outdoor air is available to make this feasible. The emergence of refrigeration air conditioning into the school field simply extends the cooling process to as much of the calendar year as school officials elect to utilize. Basic design principles remain the same, and the main pitfall for the design engineer to avoid is that of forgetting the long-established problem of wintertime cooling when addressing himself to the new one of summer air conditioning.

ACTIVITIES OF SOCIETY CHAPTERS

At recent meetings, some of the chapters were privileged to receive Officers' Visits or to hear their Regional Directors Report. Along with a variety of General Technical Talks, such subjects as Solar Energy, Noise Problems and Natural Gas were widely discussed. Additional Student Programs, conducted Tours and Non-technical Programs are noted here. Personal items on members show that many deserved individual mention.

Officers' Visits

A guest speaker at a BLUEGRASS Chapter meeting, A. J. Hess, Los Angeles, Calif., who was then 2nd vice president of the Society, gave some introductory remarks about Society activities. Mr. Hess then related some of his experiences concerning design and installation of heating, air-conditioning and ventilating systems in greenhouses for the study of *Solar Energy of Growing Plants.* • • • E. R. Queer, University Park, Pa., gave his educational address on *Air Conditioning of Caves for Underground Storage* for the benefit of the members and guests of the ONTARIO Chapter. Professor Queer was 1st vice president of the Society at the time of this presentation.

Regional Directors Report

A. B. Algren, Minneapolis, Minn., regional director of Region 3, reviewed the duties of the region for a large MINNESOTA Chapter audience, stating that there is a need for greater interest in regional meetings for closer Society contact. • • • A brief outline of the general operation of the Society given by W. G. Hole, Montreal, Que., regional director of Region 7, was well received by the NORTHERN ALBERTA Chapter members. • • • C. B. Gamble, New Orleans, La., who is regional director of Region 5, at a NORTHERN PIEDMONT Chapter meeting remarked on the rapid growth of the Society, noting that the 40 chapters of a few years ago have now increased to over 70. He also mentioned the increasing research activities which will make more design data available. In an address on *Electronics and Air Conditioning*, Mr. Gamble described the design and working principles of air-conditioning systems for machines. He specified several limiting conditions which affected the design, such as required temperatures, humidity, machine layout, and the usual lack of space.

General Technical Talks

At a meeting held jointly by *ASRE* and the ASHAE ATLANTA Chapter, the guest speaker, John von Bergen, Airkem, Inc., New York, N.Y., presented an interesting program on *Odor Controls.* After the talk, several pieces of equipment were displayed, demonstrating different types of applications. • • • *Who Says Dirt Is Cheap?* was the question posed by R. H. Jacobs, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., at a BALTIMORE Chapter meeting. This well-organized talk was supplemented by a large number of slides. • • • An audience of BLUEGRASS Chapter members and guests enjoyed a slide presentation and talk on the highlights of a new brochure on the *Economics of Air Conditioning.* Will Gove, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., was the speaker. • • • C. F. Kroshel, Bacharach Industrial Instrument Co., Pittsburgh, Pa., gave an illustrated lecture on *Adjusting with Instruments for Fuel Economy and Performance* at a CENTRAL NEW YORK Chapter meeting. • • • CHAPITRE DE LA VILLE DE QUEBEC featured a talk by M. Samuel Aboud, president and manager, Rock Utilities, Ltd., Montreal, Que. The speaker first outlined the different kinds of burners adapted to the various types of boilers, as well as their characteristics and limitations. M. Aboud then discussed steam production, giving the principal characteristics of operation of each sort of burner. Some examples of practical calculations were presented for several of the problems encountered when estimating circuits and equipment for use with heavy oil. At a previous meeting of the Quebec chapter, the speaker was G. Lorne Wiggs, senior partner, Wiggs, Walford, Frost & Lindsay, Westmount, Montreal, Que. M. Wiggs spoke of *High-Temperature Water* as an ideal system for district heating. Numerous examples in support of his contention were given, with special emphasis on the military camp at Gagetown, N.B. The principal interesting details were covered in a slide presentation. • • • Enthusiastic reception greeted a talk on *Heat Pumps and Their Application* by Jack Whitson, York Corp., York, Pa., at an ILLINOIS-IOWA Chapter meeting. The talk was followed by a lively question and answer period. • • • An *Evaluation of Air Cleaning Equipment* was made at a JACKSONVILLE Chapter meeting by G. F. Landgraf, vice president, engineering, Trion, Inc., Pittsburgh, Pa. • • • The showing of colored graphic charts, emphasizing the fact that

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air conditioning is a sound business investment, enhanced a presentation by F. M. Neal, sales engineer, Minneapolis-Honeywell Regulator Co., Los Angeles. Mr. Neal's address, given at a meeting of the KANSAS Chapter, was entitled *The Economic Advantages of Complete Year-Round Air Conditioning*. The *Factors Affecting Cooling Coil Applications* were described at another Kansas Chapter meeting by W. P. Glancy, southwest district manager, Aerofin Corp., Dallas, Tex. Upon completion of Mr. Glancy's informative talk, a question and answer period was held. • • • KANSAS CITY Chapter featured addresses by S. L. Richardson, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., on fluorinated hydrocarbon refrigerants—now and to come, and by A. M. G. Moody, chief engineer, The Trane Co., La Crosse, Wis., on *Hermetic Centrifugal Compressors*. • • • An audience of MASSACHUSETTS Chapter members and guests heard John Engalitcheff, Jr., president, Baltimore Aircoil Co., Inc., Baltimore, Md., in an informative talk on *Water Conservation Equipment—Theory and Application*. • • • MINNESOTA Chapter's presentation on *Local Ground Water Problems* by A. E. Meyer, consulting engineer, was enthusiastically received. • • • *Shootin Service* was the provocative title selected by F. L. Vaughn, Sporlan Valve Co., St. Louis, Mo., for the valuable information he gave in an address delivered before the MISSISSIPPI Chapter. • • • Members and guests of the NEW MEXICO Chapter were enlightened on the *Economic Advantages of Year-Round Air Conditioning* by E. A. Thompson, regional manager, Minneapolis-Honeywell Regulator Co., Denver, Colo. • • • At a joint meeting of the NEW YORK Chapter of ASHAE and the local *ASRE* Chapter, Paul Aitkenhead, president, Electro-Air Cleaner Co., Pittsburgh, Pa., spoke on the *Application of Electric Air Cleaning to Air Conditioning*. Discussing the air conditioning of large buildings at a previous New York Chapter meeting, A. I. McFarlan, president, A. I. McFarlan, Inc., New York, N.Y., covered such points as improved volume control, humidity control without reheat, larger heat transfer surfaces, staged cycle and 3-pipe heat pump systems. In this talk on *Staged Cycle and Closed Reversing Cycle*, Mr. McFarlan gave a cogent economic study while comparing different systems. • • • NORTH TEXAS Chapter, meeting jointly with *ASRE*, scheduled a talk by P. V. Travis, chief plumbing inspector for the City of Dallas. The subject of Mr. Travis' talk was *The Effect of the New Dallas Air Conditioning and Ventilating Code on the Air Conditioning Trades*. In the ensuing question and answer period, H. G. Jennings, district plumbing inspector for the City of Dallas, assisted in the replies to questions. • • • The sound economics of air conditioning were expounded by R. L. Patton, branch commercial manager, Minneapolis-Honeywell Regulator Co., Dallas, Tex., for a NORTHEASTERN OKLAHOMA Chapter audience. Mr. Patton used colored slides in his analysis of the components of poor and good air-conditioning installations and of the cost factor, for both commercial and residential installations. • • • Problems encountered in *Warm Air Furnace Design and Manufacture* were treated by a NORTHERN ALBERTA Chapter speaker, George Lunde, manager, Furnace-Aire, Ltd., Edmonton, Alta. • • • A lively question and answer period followed a talk on *Shopping Center Air Conditioning* by J. D. Olivieri, consulting engineer, who was a NORTHERN OHIO Chapter guest speaker. Mr. Olivieri first described the 3 basic types of shopping centers as the strip, regional and district types. From this point he ventured into the methods best suited for air conditioning each type. • • • Speaking on *Automobile Air Conditioning* at a joint meeting of the NORTHERN PIEDMONT Chapter of ASHAE and the *ASRE* North Carolina Chapter, Mr. Carter elaborated in detail on methods of reducing the cooling capacity after the comfort conditions in a moving car are reached. The speaker explained the characteristic curves of automobile air conditioning and described the stages of development. Mr. Carter, who handled the not-too-well-known subject of automobile air conditioning in an expert manner, predicted that as many as 25 percent of all cars may be equipped with air-conditioning units next year. • • • The OTTAWA VALLEY Chapter scheduled a program on heating and cooling with high-velocity single- and double-duct systems. The speaker, W. Peters, Research Division, Anemostat Corporation of America, Hartford, Conn., displayed a masterful style. Ottawa Valley Chapter members also heard G. A. Robb, an engineer in the employ of a large paper mill in the area, speak on the many problems of ventilation and heat reclaim which are a constant source of worry in such mills. To strike a balance between employee comfort and plant economy is the chief aim of plant engineers, according to Mr. Robb. • • • W. S. Harris, research professor, mechanical engineering, University of Illinois, Urbana, addressed the PHILADELPHIA Chapter on *Infiltration in Buildings*. • • •

ASHAE AND *ASRE* GROUPS MEET IN ALBANY

Among those in attendance at a recently held joint meeting of the Empire State Capital Chapter of ASHAE and the Hudson-Mohawk Section of *ASRE*. (L. to r.) Seated: E. J. Mahoney, H. F. Kruger (ASHAE); D. D. W. Lambert, Jr., R. D. Marshall (*ASRE*). Standing: M. E. Waddell, B. E. Mullen (ASHAE); L. M. Brown, P. G. Fournier, and H. Levine (*ASRE*)

Considerable discussion followed an impressive talk at a PITTSBURGH Chapter meeting on *Radiant Heating, Cooling and Controlled Human Comfort*, given by W. C. Kadow, liaison engineer, Burgess-Manning Co., Chicago. • • • Many uses of high-efficiency filters in the industrial field were brought to the attention of the ST. LOUIS Chapter members by D. H. Northrup, president, Cambridge Filter Corp., Syracuse, N.Y., when he addressed the chapter on *High-Efficiency Filters as Used in Industrial and Comfort Applications*. • • • *The Performance and Characteristics of Axial Flow Fans* were described for the benefit of the SOUTH TEXAS Chapter members by D. D. Herrman, chief engineer, Hartzell Propeller Fan Co., Piqua, Ohio. • • • G. M. Anderson, general manager, Fluor Products Co., the Air Conditioning and Refrigeration Cooling Tower Division of the Fluor Corp., Ltd., Whittier, Calif., gave an interesting presentation on the design of cooling towers and recommended operating conditions at a meeting of the SOUTHERN CALIFORNIA Chapter. The talk was followed by a film on the pro-

curement of redwood lumber, and manufacturing, assembly and operation of cooling towers. • • • In an introductory talk at a TOLEDO Chapter meeting, J. F. Guest reported for THE GUIDE review committee on Chapter 40, Sound Control. He pointed out that this chapter gives all the necessary tools to work with and criteria for various applications. The main speaker of the evening, F. J. Linsenmeyer, sales engineer, Nichols Co., Detroit, Mich., offered a discussion of *Ceiling Radiant Heating and Cooling.* • • • An educational program on the new engineering test reactor at Arco, Ida., was scheduled by the UTAH Chapter. W. L. Stuewe, branch manager, Minneapolis-Honeywell Regulator Co., Salt Lake City, Utah, gave the illustrated talk. • • • Charles Schumann, Janitrol Heating and Air-Conditioning Division, Surface Combustion Corp., Columbus, Ohio, gave the VIRGINIA Chapter valuable information on duct heater applications. • • • *Residential Application and Operating Costs of the Waterless Air Conditioner* were covered at a WESTERN NEW YORK Chapter meeting by W. J. Radle, performance analyst, Airtemp Division, Chrysler Corp., Dayton, Ohio. • • • The uses and types of controls in the various forms of heat transfer and air control equipment were demonstrated by B. L. Vehorn, branch manager, The Powers Regulator Co., Greensboro, N.C., for the benefit of the student members of the NORTH CAROLINA STATE COLLEGE Student Branch. Mr. Vehorn was assisted in his lecture and demonstration by C. F. Atkinson, also a representative of The Powers Regulator Co. At another meeting of the North Carolina State College Student Branch, W. M. Wallace, II, consulting engineer, Durham, N.C., outlined the various types of heating, stressing the fact that the field is broader than most people realize.

Solar Energy Discussed

At a meeting of the ARIZONA Chapter, J. W. Elmore, professor, Arizona State College at Tempe, told of the methods used to develop 2 programs of construction business study. The electronic brain at Arizona State College is in charge of the project. Together with J. I. Yellott, secretary-treasurer, *Association for Applied Solar Energy*, Phoenix, Ariz., Professor Elmore discussed the design of the solar energy house. The first 5 winning entries in their international design contest were shown. • • • Solar heat, with an emphasis on home heating, was treated by Calvin MacCracken, president, Jet-Heat, Inc., at a NORTH JERSEY Chapter meeting. Detailed data on heat traps and general information on types of thermal storage were covered. The winning designs from the national architectural contest for solar heated homes, sponsored by the *Association for Applied Solar Energy*, were on display, and the highlights of some of the winning designs were noted. Mr. MacCracken also displayed a solar oven which could be used to cook food at a temperature of 350 F, using only the heat collected from sunlight. The scope and number of questions asked in the ensuing question period evidenced the members' interest. • • • An extensive question period made evident the great interest of the WEST TEXAS Chapter members in a program on *Solar Heating*. F. H. Bridgers, partner, Bridgers & Paxton, Albuquerque, N. Mex., was the speaker.

CERTIFICATES FOR CENTRAL N. Y. CHAPTER PAST PRESIDENTS

The Central New York Chapter recently started the practice of presenting a Certificate of Appreciation to each past president. When the first certificates were ready, no less than 9 of the past presidents were on hand. Seated (*l. to r.*): C. M. Ashley, V. S. Day, H. G. Strong, and J. H. Carpenter. Standing: Merle Weninger, F. E. Krell, H. J. Morton, F. D. Putnam, and L. A. Childs

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Solving Noise Problems

Speaking at a meeting of the ATLANTA Chapter, Charles Overend, Koppers Co., Inc., Baltimore, Md., explained methods of *Predicting Noise Reduction Requirements in Air Distribution Systems.* • • • Noise problems in different facets of heating, ventilating and air-conditioning systems were the subject of a talk by H. C. Hardy, Howard C. Hardy and Assocs., who spoke to an ILLINOIS Chapter gathering. Pointing out the varying acceptability of sounds, the speaker demonstrated with slides and recorded messages. • • • R. D. Lemmerman, manager, Koppers Co., Inc., Baltimore, Md., was concerned with *Noise and Noise Reduction in Air-Conditioning Systems* in his informative presentation to the NORTHERN OHIO Chapter. • • • *A Method of Noise Control Analysis in Room and Distribution Systems* was described by W. L. Batchelor, chief engineer, Tuttle & Bailey, Division of Allied Thermal Corp., New Britain, Conn. This presentation at a meeting of the SOUTHWEST TEXAS Chapter was judged to be one of the most enlightening talks which the chapter had heard on sound and sound control. • • • According to James Gildard, senior project engineer, Koppers Co., Inc., Baltimore, Md., the major source of noise in air distribution systems is fans, but transmission of sound from one space to another through ductwork is another problem which must be considered. In his discussion of *Noise Control in Air Distribution Systems* at a WISCONSIN Chapter meeting, Mr. Gildard explained the rating of sound levels by the decibel method and enumerated the various methods of reducing sound.

Natural Gas Studied

Planning needed for the changeover from present gas distribution to the handling of natural gas was elaborated on by Mr. Lucas, vice president and general manager, The Quebec Natural Gas Corp., at a meeting of the MONTREAL Chapter. Following his interesting outline on the subject, Mr. Lucas answered questions on the effect of this new fuel source on the established oil market of the area, rates of the gas and corrosion problems. • • • Highlighting his talk at a NEBRASKA Chapter meeting, M. L. Mead, chief engineer, Northern Natural Gas Co., Omaha, Nebr., presented some amusing and informative demonstrations and displays on the use and storage of natural gas. • • • *Fuel Economics*, with emphasis on natural gas, was the topic covered by a NORTHERN ALBERTA speaker, M. E. Stewart, general manager, Northwestern Utilities, Ltd., Edmonton, Alta. • • • The PUGET SOUND Chapter members and their guests enjoyed hearing C. A.

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Linde, assistant commercial sales manager, Washington Natural Gas Co., Seattle, Wash., speak on *Supply, Transmission, Distribution and Rates for Natural Gas in the Pacific Northwest.* Mr. Linde also discussed the fire prevention and explosion code now being drafted by the City of Seattle. • • • *Gas as a Fuel* was the subject of a talk by L. S. Reagan, vice president and general manager, The Webster Engineering Co., Tulsa, Okla., at a WISCONSIN Chapter meeting. Mr. Reagan's talk dealt with the availability of natural gas, along with the economic aspect, application, and some of the basic engineering problems. The speaker closed with a short discussion on efficiencies of the various fuels and the principles of combustion.

Student Programs

The NORTH CAROLINA STATE COLLEGE Student Branch programmed a movie entitled *Steam for Power.* It described the history and construction of boilers used in steam generating for steam turbines. • • • Meeting jointly with the INDIANA Chapter, students of the PURDUE UNIVERSITY Student Branch heard A. I. McFarlan, president, A. I. McFarlan Co., Inc., New York, N. Y., explain a year-round air-conditioning system.

Tours

Members of the CONNECTICUT Chapter toured the new home office building of the Connecticut General Life Insurance Co., Bloomfield, Conn. An insight into the evolvement of the building's final design was given by B. P. Hayden, secretary, mortgage loan and real estate department of the company. • • • E. V. Gritton described the general layout of the air-conditioning system prior to a UTAH Chapter tour of the new office building of the Mountain Fuel Supply Co., Salt Lake City, Utah. The tour was conducted by R. G. Williams and Mr. Gritton of Williams, Gritton & Wilde. • • • Following a brief business meeting of the WESTERN MASSACHUSETTS Chapter, G. C. Jamison, industrial consultant, Western Massachusetts Electric Co., Springfield, Mass., spoke of the expansion needs for electrical power. Mr. Jamison also introduced the main speaker of the evening, N. W. Blanchard, assistant superintendent, West Springfield Station, Western Massachusetts Electric Co., who reviewed the area development described by Mr. Jamison, lectured on plant facilities and outlined the process of electrical generation. Tours of the West Springfield Station power plant completed the program. • • • A conducted tour of the air-conditioning installation of the Marine Trust Building preceded a WESTERN NEW YORK Chapter meeting, which was held jointly with *ASRE.* Three speakers graced the podium at the meeting; all placed particular emphasis on the absorption air-conditioning installation viewed during the tour. D. D. Hinman, R. S. Bald and W. A. Bingham, all of Carrier Corporation, Syracuse, N.Y., spoke respectively on the air-conditioning system, the absorption refrigeration machine, and organization and execution of the installation of the system. • • • Student members of the PURDUE UNIVERSITY Student Branch heard F. H. Montague, mechanical engineer, Walter Scholer & Assocs., Lafayette, Ind., in a short talk on the heating and ventilating system in the new Purdue University recreational gymnasium. After the talk, which was supplemented by detailed drawings, Mr. Montague conducted the student branch on an inspection tour of the installation.

AT CANADA'S POWER SHOW

Among the exhibitors at Canada's Power Show held in Toronto last fall, along with meetings and technical sessions, was the Toronto Chapter, ASHAE. Shown above is a view of a portion of the exhibit booth

Non-technical Programs

Predictions on the industrial future of Louisville, Ky., were presented at a BLUEGRASS Chapter meeting by K. P. Vinsel, Louisville Chamber of Commerce. Mr. Vinsel related the part in the city's future which will be played by the Chamber of Commerce. • • • Members of the INLAND EMPIRE Chapter accompanied Ralph Nelson on a *One-Man Safari to Kilimanjaro.* The narration was illustrated with excellent slides. • • • L. E. Seeley, a past president of the Society, who is vice president, engineering, The H. B. Smith Co., Inc., Westfield, Mass., offered a superior program entitled *A Plan for Financial Support of Engineering Education.* The close attention of the MASSACHUSETTS Chapter audience and the active question and answer period following evidenced the appropriateness of the subject and the effectiveness of the speaker. • • • ROCKY MOUNTAIN Chapter scheduled a talk by J. F. McCauley, president, *HP & ACCNA* of Denver, Colo. Mr. McCauley presented a talk on the responsibilities of suppliers, engineers, architects, subcontractors and contractors in mechanical work. Several proposed bidding breakdown procedures were outlined in detail, resulting in a timely presentation. • • • A WESTERN MICHIGAN Chapter meeting was turned over to Wayne Miller, Grand Rapids, Mich., who showed colored slides of a fascinating trip around the Mediterranean Sea.

Personals

Pres. R. E. Dressell, BALTIMORE Chapter, while convalescing from a recent illness, paid a visit to his chapter. • • • It was announced by Pres. W. W. Dodge, ILLINOIS-IOWA Chapter, that the chapter has become a member of the *Peoria Engineering Council* and that P. J. Hannon will be the chapter's representative. • • • Fifteen of the twenty-five living past presidents of the MASSACHUSETTS Chapter were honored at a recent meeting. Introduced to their fellow members were Past Presidents E. A. Dussosoit, David Moulton, F. R. Ellis, H. C. Moore, C. P. Yaglou, J. W. Brinton, D. M. Archer, C. W. Larson, Adolph Ehrenzeller, John Bonner, G. B. Torrens, A. L. Hare, G. W. Sprague, G. D. Fife and W. G. Martin, Jr. Mr. Dussosoit led the group, having been president of the chapter in 1925. • • • The MINNESOTA Chapter membership was pleased to hear that H. C. Mills was out of the hospital and doing well. • • • At a MONTREAL Chapter meeting, student awards were presented for the best papers on air conditioning to J. Edge of McGill University by W. G. Hole, regional director, Region 7, and to Professor Bouthillette in the name of Y. Larougery of Ecole Polytechnique by Pres. D. J. McIntyre. • • • J. H. Van Alsburg, H. F. Munn, R. E. Jensen and J. L. Breese were appointed as a committee to arrange a special program for the NEW MEXICO Chapter. • • • Pres. C. W. Watson, OTTAWA VALLEY Chapter, announced that Jacob Klassen had been appointed as a member of the hospital safety committee, *CSA.* Mr. Watson expressed his feelings that this not only reflected on Mr. Klassen, but it also was an honor of which the chapter could be justifiably proud. • • • C. G. Binder, PHILADELPHIA Chapter, received his Life Membership certificate from E. K. Webster. Philadelphia Chapter business also included the election of J. J. Hucker as program committee chairman. • • • Out-of-town guests introduced at a WISCONSIN Chapter meeting included Phil Ellis, Barber-Colman Co., Brussels, Belgium, and Hans Sprong, Barber-Colman Co., Amsterdam, Holland. L. C. Plaehn, who had been elected Milwaukee Engineer of the Month, received the congratulations of the Wisconsin Chapter for his fine work and many contributions to the field.

ARIZONA CHAPTER HEARS SPACE FLIGHT EXPERT

Taking part in a meeting sponsored jointly by 8 Arizona engineering societies, the Arizona Chapter of ASHAE heard

K. A. Ehricke state that he believes that the launchings of rockets to the Moon and space between Venus and Mars will be the next probable step in space flight.

The talk by Mr. Ehricke was only one of the features on the program, most of which was conducted at Arizona State College at Tempe, Ariz., and which included also panel sessions on *Educating Tomorrow's Engineers* and *Developing the Engineer in Industry*.

PERSSON BECOMES VICE PRESIDENT

N. B. Persson, Society member since 1937, is now vice president of Stephens-Bangs Associates, Inc., Detroit, Mich., a firm which specializes in consulting work in connection with engineering of food facilities.

JOURNAL SECTION

HONORED BY LIFE MEMBERSHIP

by formal action of Society's Council

David Caleb

Kansas City, Mo.: ▸ Entered service of Kansas City Electric Light Co. (now Kansas City Power & Light Co.) in 1910 as tracer in the drafting room.
▸ Continued with that company to date, except for service overseas in World War I; now project engineer handling large heavy construction.
▸ Elected president of Kansas City Chapter for 1933.
▸ Holds life membership, *NDHA*.

H. Berkley Hedges

Philadelphia, Pa.: ▸ Has been divisional sales manager, John J. Nesbitt, Inc., for 22 years.
▸ Studied at University of Kentucky, B.M.E. in 1914.
▸ Experienced in sales and management, Kewanee Boiler Co., York and Carrier Corporations.
▸ Served on Nominating, Chapters Conference Committees; chairman, Admission and Advancement.
▸ Elected to presidency, New York and Philadelphia Chapters.

Richard D. Madison

Buffalo, N.Y.: ▸ Connected with Buffalo Forge Co. since 1919; named director of research, 1955.
▸ Was graduated from Rose Polytechnic Institute, B.S., 1913; M.E., 1926, on professional record.
▸ Helped design 1st U.S. tanks.
▸ Has written on air conditioning.
▸ Edited *Fan Engineering*.
▸ Holds patents on fans, etc.
▸ Active on ASHAE committees: Research, Publications, TAC's; various societies' code committees.

Paul H. Schoepflin

New York, N.Y.: ▸Established the Niagara Blower Co. in Buffalo, N.Y., in 1919; serving as president ever since.
▸Was graduated from Syracuse University, B.S., 1912.
▸Won varsity letter in baseball 3 years; captained hockey team.
▸Entered partnership, Schoepflin and Tepas, 1915; blower system work.
▸Served in U. S. Army, 1917-19.
▸Is a member of Psi Upsilon; clubs in Buffalo, Boston, and N.Y.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 133 men who are candidates for membership or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before February 28, 1958, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: ******Advancement* **†***Reinstatement*

California (*Region* 4)

BEATY, E. M.†, Industrial Gas Engr., Pacific Gas & Electric Co., Sacramento.
CASTAGNOLI, GUIDO, Supt., Reliable Heating, Air Conditioning Co., San Jose.
GREENE, G. A., JR., Cons. Engr., Porter & Greene, San Jose.
HACKBARTH, J. K., Sales Engr., G. L. Bauserman Refrigeration Co., Los Angeles.
MICHELI, N. V., Mgr. Industrial Insulators, Emeryville.
MIDDLETON, H. C., Chief Engr., Grand Heating & Air Conditioning, Inc., Los Angeles.
SLACK, D. J., Repr., General Electric Co., Los Angeles.
SPRUILL, J. A., Territory Mgr., Lennox Industries Inc., Piedmont.
STUCKER, O. E., Jr. Mech. Engr., California State Division of Architecture, Sacramento.
WEBER, H. C.†, Design Engr., J. L. Hengstler, Los Angeles.

Colorado (*Region* 3)

D'AMICO, A. A.*, Sales Engr., Herman & von Rosenberg, Denver.
HICKERSON, W. D., Sales Engr., McCombs Supply Co., Denver.
JOHNSON, J. E., Asst. Vice Pres., Natkin & Co., Denver.

Connecticut (*Region* 1)

THOMAS, J. B. C., Sales Engr., Hartford Electric Light Co., Wethersfield.

District of Columbia (*Region* 5)

TEPPER, LEON, Vice Pres., A. S. Johnson Co., Inc., Washington.
WEBSTER, G. G., Engrg. Draftsman, C. Warren Bogan & Assoc., Washington.

Georgia (*Region* 5)

ANDERSON, C. D., Power Sales Engr., Savannah Electric & Power Co., Savannah.
AUTRY, L. K., Estimator, M. O. Seckinger Co., Savannah.
CATES, J. M., Chief Engr., Engineering Section, U. S. Air Force, Hunter Air Force Base, Savannah.
CLAUSEN, CARL, Secy.-Treas., Clausen-Williamson Co., Inc., Savannah.
EVANS, W. B., Lighting Engr., Savannah Electric & Power Co., Savannah.
MCGRATH, J. R., Service Mgr., Mingledorff's, Inc., Savannah.

JOURNAL SECTION

WILLIAMSON, B. L., Pres., Clausen-Williamson Co., Inc., Savannah.

Illinois (*Region* 2)

BEYER, E. C., Estimator, Culberg Asbestos & Cork, Chicago.

CURTIN, W. M., Owner, Curtin Plumbing & Heating Co., La Salle.

FISHER, G. W., Chief Mech. Engr., L. C. Spiehs Co., Inc., Chicago.

FORD, F. J., Chief of Div. Vtg. & Warm Air Furnace Plan Examination Dept. of Bldgs., Bureau of Htg. Vent. & Ind. Sanitation, Chicago.

GLEASON, R. D., Assoc. Engr., Brooke & Choporis, Chicago.

KRAMER, W. H.*, Mgr. Htg. Div., Chase Supply Co., Chicago.

MILLER, H. E., Owner, Edward Miller Sheet Metal Shop, La Salle.

NELLES, MAURICE, Vice Pres. of Engrg., Crane Co., Chicago.

SCHARRES, H. J., Assoc., E. R. Gritschke & Assocs., Chicago.

TYK, R. C., Sales Engr., Gustin-Bacon Manufacturing Co., Chicago.

WILSON, K. D., Asst. Chief Engr., George Evans Corp., Moline.

ZIMMERMAN, H. E., Sales Engr., Warren Webster Co., Peoria.

Indiana (*Region* 2)

BESCHLOSS, M. R., Asst. Sales Mgr., Hammond Brass Works, Hammond.

MCCOLLUM, J. L., Research Analyst, American Rock Wool Corp., Wabash.

SCHILKE, D. W., Sales Engr., American Blower Div., American-Standard, Indianapolis.

TOWER, ARCHIE, Dist. Mgr., The Trane Co., Indianapolis.

WICKLINE, E. E., Field Engr., J. C. Penney Co., Indianapolis.

Kansas (*Region* 3)

TAYLOR, E. W., Owner, Taylor Refrigeration & Heating Co., Topeka.

Louisiana (*Region* 5)

MALLARY, M. C., Indus. Sales Engr., Reed Unit-Fans, Inc., New Orleans.

Maryland (*Region* 5)

INSLEY, N. E., Jr., Proj. Engr., Lloyd E. Mitchell, Inc., Baltimore.

TWELE, E. R., Sales Engr., Minneapolis-Honeywell Regulator Co., Baltimore.

Massachusetts (*Region* 1)

BOREK, G. S., Asst. Proj. Mgr., Henry J. Nickel, Cons. Engr., Boston.

BRESNIHAN, JOHN, Sales Engr., John J. Nesbitt, Inc., Newton Highlands.

FINNERTY, J. A.†, Mfrs. Agt., John A. Finnerty Co., Newton Highlands.

KOHLER, J. W. A., Pres., Homans-Kohler, Inc., Brookline.

LORD, E. R., Engr., Bldg. Service Div., Stone & Webster Engineering Corp., Boston.

MILO, JOHN, Cons. Engr., Joseph C. Bogue, Belmont.

O'CONNOR, J. F., Sales & Appl. Engr., American Blower Div., American-Standard, Boston.

Michigan (*Region* 2)

GARST, J. L.†, Sales Engr., Saunders & Co., Detroit.

GREEN, C. L., Sales Engr., Schmieg Industries, Inc., Centerline.

LABBANCZ, J. F.*, Gen. Mgr., R. L. Spitzley Heating Co., Lansing.

MUELLER, G. R., Sr. Engr., Giffels & Rosetti, Detroit.

TWIETMEYER, H. E.†, Plt. Engr., Research Staff, General Motors Corp., Detroit.

Minnesota (*Region* 3)

DOWELL, K. F., Mech. Engr., Scott Whitnah, Inc., Minneapolis.

WENTZ, C. H., Mech. Engr., Ellerbe & Co., St. Paul.

Missouri (*Region* 3)

ALBIN, E. L., Sales Engr., Dunham-Bush, Inc., Brentwood.

BEVIRT, W. D., Vice Pres. & Gen. Mgr., D. F. Edwards Heating Co., St. Louis.

JAEGER, F. G., Field Engr., Sporlan Valve Co., St. Louis.

Montana (*Region* 3)

STEIN, L. K., Engr. & Chief Draftsman, R. L. Prussing Engineers, Billings.

Nebraska (*Region* 3)

HART, W. E., Sr. Mech Engr., Henningson, Durham & Richardson, Omaha.

PAULSON, L. J.*, Sales Engr., Minneapolis-Honeywell Regulator Co., Omaha.

New Mexico (*Region* 6)

BAXTER, H. H., Engr., Sandia Corp., Albuquerque.

New York (*Region* 1)

BALSAM, P. W.*, Engr., Jas. H. Martin, Inc., New York.

BERGER, ADOLPH, Plbg. Engr., Voorhees Walker Smith & Smith, New York.

DI GIACOMO, W. A.*, Cons. Engr., New York.

JAMESON, R. L., Br. Com. Sales Mgr., Minneapolis-Honeywell Regulator Co., Buffalo.

KOPECKY, J. J.*, Proj. Engr., Voorhees Walker Smith & Smith, New York.

KORNBLUM, H. R.*, Pres., Double-Kaye Plumbing Supply Co., Inc., New York.

POMERANTZ, HERBERT*, Group Chief, Voorhees Walker Smith & Smith, New York.

ROSE, ROBERT, Engr., Voorhees Walker Smith & Smith, Long Island City.

YANKAUSKAS, GEORGE, Designer, Voorhees Walker Smith & Smith, Long Island City.

North Carolina (*Region* 5)

NISBET, J. R., Partner, Mec-Tric Control Co., Charlotte.

Ohio (*Region* 2)

DAVISSON, D. N., Sales Service Engr., Perfection Industries, Div. of Hipp Corp., Cleveland.

GARDNER, B. G., Sales Engr., Powers Regulator, Cleveland.

JONES, W. V.*, Vice Pres., J. A. Guy, Inc., Dublin.

Pennsylvania (*Region* 1)

AMOROSO, G. J., Mech. Engr. GS 12, Philadelphia Naval Base, Philadelphia.

BASTOW, JOSEPH, Jr., Supt. Engr., Charles A. Reiter, Pittsburgh.

JOHNSON, W. M., Owner, Bill Johnson Mfg's Agent, Pittsburgh.

MILLER, S. W., Jr.*, Dvlpt. Engr., John J. Nesbitt, Inc., Philadelphia.

NEWTON, J. M., Sales Engr., American Air Filter Co., Pittsburgh.

POTTER, W. G., Mgr. Com. Space Htg. Divs., Edwin L. Wiegand Co., Pittsburgh.

ROTT, J. R., Sales Engr., R. D. Bitzer Co., Inc., Philadelphia.

RUDOY, WILLIAM, Assoc. Prof., Mech. Engrg., University of Pittsburgh, Pittsburgh.

SHINGLER, M. E., Sales Repr., Amstan Supply Div., American-Standard, Altoona.

YEOMANS, R. B., Design Engr., Paul H. Yeomans, Philadelphia.

ZIMMERMANN, J. A., Jr., Sales Engr., American Blower Corp., Philadelphia.

Tennessee (*Region* 5)

COX, J. C.*, Assoc. Engr., Union Carbide Nuclear Co., Oak Ridge, Tenn.

RAMSEY, G. B., III*, Engr., George Wilson Co., Memphis.

Texas (*Region* 6)

BARNHART, B. J.*, Owner-Mgr., Cinbar Engineering Co., Austin.

HORSTMANN, A. L., Estimator, J. M. Boyer, Austin.

Utah (*Region* 4)

KITLEY, B. W., Sales Engr., Western Sales Service, Salt Lake City.

Virginia (*Region* 5)

EASTER, J. C., Asst. Dist. Mgr., Ric-wiL, Inc., Alexandria.

Washington (*Region* 4)

BOGGESS, H. V., Engrg. Job Supvsr., L. G. Massart Plumbing & Heating Co., Seattle.

FARRAR, G. L., Mech. Engr., Lent's, Inc., Bremerton.

LAATZ, L. F., Estimator, L. G. Massart Plumbing & Heating Co., Seattle.

West Virginia (*Region* 5)

BROWN, J. W., Jr., Installation Supt. Controls Inc., Morgantown.

Wisconsin (*Region* 2)

DONALDSON, J. R., Sales Engr., Allan Engineering Co., Milwaukee.

KOTECKI, S. F., Engr., Industrial Heating & Engineering Co., Milwaukee.

SHELDON, J. F., Research Engr., A. O. Smith Corp., Milwaukee.

Canada (*Region* 7)

BODNER, R. J., Chief Estimator-Contract Dept., F. Drexel So. Ltd., Vancouver, B. C.

BOWIE, G. J., Vice Pres., F. G. Bowie & Sons, Ltd., Ottawa, Ont.

BRAID, F. A., Mech. Designer, Kappele, Wright & MacLeod, Toronto, Ont.

BRUCE, WILLIAM, Prof. of Mech Engrg., McGill University, Montreal, Que.

BURRIDGE, L. E., Sr. Mech. Asst., Canadian National Railways, Montreal, Que.

COLLINS, J. J., Mech. Proj. Engr., Ontario Hydro, Toronto, Ont.

CROWTHER, E. J., Pres., Crowther, MacKay & Assocs., Ltd., Calgary, Alta.

FERTUCK, E. A., Sales Engr., American Air Filter of Canada, Ltd., Toronto, Ont.

GIFFORD, R. M., Design-Draftsman, Canadian Arsenals, Ltd., St. Paul, L'ermite, Que.

HARRIS, W. G., Repr., Darling Bros, Ltd., Montreal, Que.

KENNARD, WILLIAM, A-C. Engr., Northern Electric Co., Ltd., Montreal, Que.

MARBACH, BERTHOLD, Engr., Air Conditioning Engineering Co. (Canada), Ltd., Montreal, Que.

MCGOWAN, H. T., Prod. Mgr., Trane Co. of Canada, Ltd., Toronto, Ont.

NELSON, G. H., Automatic Control Sales & Appl. Engr., Wells H. Morton & Co., Ltd., Calgary, Alta.

SAMPSON, E. H., Vice Pres., E. T. Sampson & Co., Ltd., Montreal, Que.

SCHWARTZ, C. W., Supvsr., Canadian Ice Machine Co., Ltd., Toronto, Ont.

SHANKS, GAVIN, Pres. & Gen. Mgr., A. & G. Shanks Plumbing & Heating, Ltd., Toronto, Ont.

SOLVASON, K. R., Assoc. Research Officer, Div. of Building Research, National Research Council, Ottawa, Ont.

THOMPSON, F. B., Sales Mgr., Crane, Ltd., Calgary, Alta.

WEBB, B. J., Tech. Repr., Trane Co. of Canada, Ltd., Winnipeg, Man.

Colombia

TOBAR, JOSE, A-C. Engrg. Dept. Head, Tecnica Colombiana S.A., Bogota.

France

RIEDEL, H. J., Staff Engr. European Operations, Worthington Corp., Paris.

Hawaii

HAMILTON, R. E.*, Engr., Honolulu.

Iran

LINDGERG, Y. J. R., Chief Engr., Sentab, Teheran.

Italy

CASALE, ALBERTO, Htg. Vtg. A-C. Designer, Litchfield, Whiting, Panero, Severud & Assocs., Rome.

DEL PRIORE, GIOVANNI, Htg. Vtg. A-C. Designer, Litchfield, Whiting, Panero, Severud & Assocs., Rome.

LUCARELLI, GIORGIO, Htg. Vtg. A-C. Engr., Litchfield, Whiting, Panero, Severud & Assocs., Rome.

Switzerland

BAUER, HUGO, Chief Engr., Landis & Gyr S.A., Zug.

KOHLI, THEODOR, Vice-Director, Zent A.G., Berne-Ostermundigan.

PAERLI, H. E., Assoc. Dir., Paerli & Co., Biel (BE).

WINTSCH, KURT, Tech. Mgr., Technicair S.A., Geneve.

OBITUARIES

LAWRENCE C. SOULE
Montclair, N. J.

Lawrence Clement Soule, secretary, Aerofin Corp., originator of the use of spiral extended-fin heat transfer surface in encased heating and cooling coils, died of pneumonia at his home in Montclair, N. J. on December 16, 1957. Mr. Soule, a long-time (1908) Member of the Society was made a Life Member by action of the Council in January 1943.

His technical paper entitled Cast Iron Hot-Blast Heaters — New Methods in Testing and a New Mathematical Formula Used in Plotting Charts and in Figuring Results, which appeared in the Society TRANSACTIONS in 1910, was the earliest one on the subject published by the Society and was a result of research conducted by Mr. Soule. He developed a basic formula which, for the first time, permitted a determination of heating capacity at any given rate of air flow over extended surfaces at an indicated temperature.

Mr. Soule was born in Bridgeton, Me., and received his S.B. degree from Massachusetts Institute of Technology. He became associated with American Blower Co. in Detroit in 1905. Following his association with American Blower and a short period with B. F. Sturtevant Co., Mr. Soule joined the staff of American Radiator Co. in 1907. His connection with the engineering and sale of cast-iron blast heaters for fan heating systems drew his attention to the problems arising with central heating coils, and from this he developed an interest in this subject which continued throughout his life.

While with the American Radiator organization during the years of 1907-1922, Mr. Soule carried on basic research work on the performance of the company's Vento cast-iron coils and as a result became the author of the *Vento Data Book* which was widely used by engineers and designers since it contained performance data presented in a highly useful fashion.

Mr. Soule was probably the first individual to clearly realize the importance and the immense possibilities which would result if coils for central fan heating installations could be successfully developed, and made available for use, using lightweight materials with physical characteristics permitting rapid transfer of heat. It is related that the full import of the situation came to Mr. Soule when he tested the performance of a borrowed fin-type radiator used on a World War I army truck. This realization led him to conduct experiments and make studies on extended fins attached to metal tubes in various ways and using various materials. Included among the studies were coils using both flat-plate and helical fins.

Lawrence C. Soule

A result of these studies was the development of the Aerofin-type coil, and the Aerofin Corp. was founded May 8, 1923 with Mr. Soule as its secretary and chief engineer.

The early product permitted use of pressures up to 50-lb gage, but soon designs were developed for use at higher pressures up to 350 lb. Later, Mr. Soule directed the design of coils embodying the same principle but suitable for use in air cooling installations. His pioneering work resulted in the granting of a patent in 1923, which was modified in 1926 and extended on cooling surface in 1930.

Mr. Soule made his home in Buffalo for many years, moving to Essex Fells, N. J., in 1925. In 1952, he moved to Montclair, N. J. He retired as chief engineer of Aerofin Corp. in 1938 and continued as corporation secretary.

He is survived by his wife, Jeannette Patterson; two sons, John P., of Upper Montclair, N. J., and Lawrence C., Jr., of Andover, Mass.; and by two grandchildren.

JOURNAL SECTION

WILLIAM ALLAN
Milwaukee, Wis.

William Allan, 55, president, Allan Engineering Co., Milwaukee, Wis., died on November 8. He was a member of the Wisconsin Chapter.

Mr. Allan was born in Castletown, Caithness, Scotland, and attended Heriot-Watt College. He started working in the foreign sales department, Bucyrus-Erie Co., South Milwaukee, Wis., in 1923. For a number of years he was connected with Chicago Pump Co. and Sims Heater Co., which later combined to form Allan Engineering Co. He became affiliated with the Society in 1938. Surviving Mr. Allan is his wife, who resides in Milwaukee.

THOMAS E. CRONE
New York, N. Y.

Thomas E. Crone, who was honored by Life Membership in the Society in 1935, died on November 21 at the age of 92. Mr. Crone, who had retired, was a member of the New York Chapter.

Born on the steamer Etna at sea on January 19, 1865, Mr. Crone had the middle name 'Etna'. He was schooled at London Collegiate Institute, London, Ont.

Working on estimates and specifications, he started in 1886 in the employ of Frank Wheeler, heating engineer, Toronto, Ont. A few years later he became Michigan representative of Pierce, Butler & Pierce Manufacturing Co., Syracuse, N.Y. In succeeding years he held the position of New York branch manager of the American Boiler Company of Chicago and Model Heating Co., and Chicago branch manager, United States Heater Co. In 1903 he was named eastern sales manager of International Heater Co., Utica, N.Y. After several years as a manufacturer's agent, he acted as New England representative, Vapor-Vacuum Heating Co., Philadelphia, Pa., during World War I. Later, he was associated with Hopson & Chapin Manufacturing Co., New London, Conn., as vice president and sales manager, and W. A. Russell & Co., New York, N. Y., as district sales manager.

A. G. MATOUSEK
Schuyler, Nebr.

The Society has been informed of the recent death of A. G. Matousek, 62, manager of the Gamble Store, Schuyler, Nebr. Mr. Matousek was a member of the Society for the past twenty years.

He was born in Brainard, Nebr., and received his mechanical engineering education at the University of Nebraska. After army service in World War I, he worked for the York Ice Machinery Corp. for over twenty years, starting as chief draftsman in the Omaha, Nebr., office and completing this employ as an engineer in the St. Louis, Mo., office. He had been manager of the Gamble Store ever since.

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Headquarters Office
62 Worth St., New York 13, N.Y.
Tel: BArclay 7-6262

(For names of Society Officers see p. 108)

Research Laboratory
7218 Euclid Ave., Cleveland 3, Ohio
Tel: UTah 1-6161

Council and Council Committees

Three Years: F. H. Faust, Fred Janssen, J. W. May, G. B. Priester.

Two Years: W. G. Hole, P. J. Marschall, W. O. Stewart, P. N. Vinther.

One Year: A. B. Algren, John Everetts, Jr., P. B. Gordon, J. N. Livermore, J. H. Ross.

Executive: A. J. Hess, Chairman; J. H. Fox, P. B. Gordon, Walter A. Grant, E. R. Queer.

Finance: J. N. Livermore, Chairman; John Everetts, Jr., F. H. Faust, P. J. Marschall, J. H. Fox (Ex Officio).

Membership: J. H. Ross, Chairman; A. B. Algren, F. H. Bridgers, Fred Janssen, W. O. Stewart.

Program and Papers: John Everetts, Jr., Chairman; W. G. Hole, J. W. May, G. B. Priester, P. N. Vinther.

Regions Central: Walter A. Grant, Chairman; F. H. Faust (1); P. J. Marschall (2); Fred Janssen (3); W. O. Stewart (4); J. W. May (5); P. N. Vinther (6); W. G. Hole (7).

Advisory Board { P. B. Gordon, Chairman; Lester T. Avery, M. F. Blankin, S. E. Dibble, S. H. Downs, E. O. Eastwood, W. L. Fleisher, H. P. Gant, H. M. Hart, John E. Haines, C. V. Haynes, L. N. Hunter, John W. James, S. R. Lewis, A. J. Offner, F. B. Rowley, L. E. Seeley, A. E. Stacey, Jr., Reg. F. Taylor, G. L. Tuve, and A. C. Willard.

General Committees

Publication: J. W. May, Chairman (one year); H. M. Hendrickson (two years); W. L. Ross (three years).

Guide: H. W. Alyea, Chairman; W. P. Chapman, R. C. Chewning, J. R. Duncan, R. A. Gonzalez, N. B. Hutcheon, M. W. Keyes, R. L. Maher, D. W. Nelson, E. F. Snyder, Jr. (Ex Officio).

Charter & By-Laws: J. C. Fitts, Chairman (one year); J. S. Locke (two years); B. R. Small (three years).

F. Paul Anderson (Honors & Awards): A. J. Hess, Chairman; John W. James, C. H. Pesterfield, N. H. Peterson, R. A. Sherman, E. F. Snyder, Jr. (Ex Officio).

Chapters Regional Committees: The list of members and alternate members for the 7 Chapters Regional Committees is scheduled to appear in the March 1958 JOURNAL SECTION.

Committee on Research: E. F. Snyder, Jr., Chairman; R. C. Jordan, Vice Chairman.

Three Years: P. R. Achenbach, S. F. Gilman, N. B. Hutcheon, R. M. Stern, H. E. Ziel.

Two Years: D. D'Eustachio, E. S. Howarth, H. R. Limbacher, E. F. Snyder, Jr., J. I. Trimble.

One Year: F. H. Faust, F. K. Hick, M.D., R. C. Jordan, H. A. Lockhart, Arthur Nutting.

Technical Advisory Committees: These are subcommittees of the Committee on Research. The 1958 personnel is scheduled to appear in the June 1958 JOURNAL SECTION. Last published list appears in December 1957 JOURNAL SECTION, p. 160.

Public Relations: E. K. Wagner, Chairman; T. V. Johnson, A. C. Lagow, E. J. Morris, R. S. Stover.

Nominating Committee

Region	Member	First Alternate	Second Alternate	
1	W. C. Kruse, Jr.	E. K. Wagner	L. A. Childs	
2	John Richmond	D. S. Falk	B. M. Kluge	
3		D. M. Allen	G. W. F. Myers	Names designated by asterisk (*) selected by the Council; others selected by Chapters Regional Committees.
4	J. E. Murray	L. A. O'Meara	R. M. Stern	
5	R. O. McGary	R. K. Rouse	W. G. Robertson, Jr.	
6	G. H. Meffert	J. S. Malahy, Jr.	F. R. Denham	
7	D. W. Thomson			
2	A. W. Edwards*			
3	B. L. Evans*	N. H. Peterson* (4)	E. J. Morris* (5)	
1	H. L. Martin*			
7	H. R. Roth*			

Society Organization Personnel

General Committees: The By-Laws provide for 9 such committees. The latest list appears in this issue (see above).

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research (see above) appoints Technical Advisory Committees as needed. The 1958 personnel is scheduled to appear in the June 1958 JOURNAL SECTION. The 1957 listing appears in the December 1957 issue on page 160

Special Committees: At present there are 9 of these committees. Last published list appears in January 1958 issue on page 238

Nominating Committee: This committee's membership is fixed by the By-Laws. The latest listing appears in this issue (see above).

Society Regional Organization: The 1958 listing of the names of the Regional Directors and of the members of the Chapters Regional Committees is scheduled to appear in the March 1958 JOURNAL SECTION.

Society Chapters and Branches: The Society has chartered 72 Chapters, 1 Overseas Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries appears in the October 1957 issue on pages 165-166

Come to the Semi-Annual Meeting 1958

A S H A E

June 23-25 **Nicollet Hotel, Minneapolis**

Evans

NEW

LOW COST *Lifelong*

air filter bank assembly

LIFELONG AIR FILTERS

All aluminum. Heavy duty. Deliver 48% more air. Catch, hold twice the amount of lint and dirt without restricting air stream. Save up to 50% on clean air maintenance costs.

LIFELONG STEEL FRAME

Precision made. Heavy gauge steel. Fast assembly. Self-locking nuts. Gasket grips, holds filter securely—no springs, latches, locks.

NEW SEAL-TIGHT GASKET

BUILT INTO FRAME (1) Pressure locks filter in position (2) Provides permanent dust-tight seal

LIFELONG SEAL-TIGHT GASKET

Polyvinyl chloride (semi-rigid PVC). Provides lasting dust-tight seal between filter and frame . . . INCREASES FILTER BANK AIR CLEANING EFFICIENCY. Maintains new product performance for life of equipment.

Evans new Seal-Tight Filter Holding Frames with Evans Lifelong Air Filters are AN UNBEATABLE COMBINATION . . . actually set a new standard for AIR CLEANING EFFICIENCY. Mail coupon for details.

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THE GEORGE EVANS CORP. MOLINE, ILLINOIS

Gentlemen: Rush complete FREE literature on NEW LIFELONG SEAL-TIGHT FILTER BANK ASSEMBLY

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COMPANY _____

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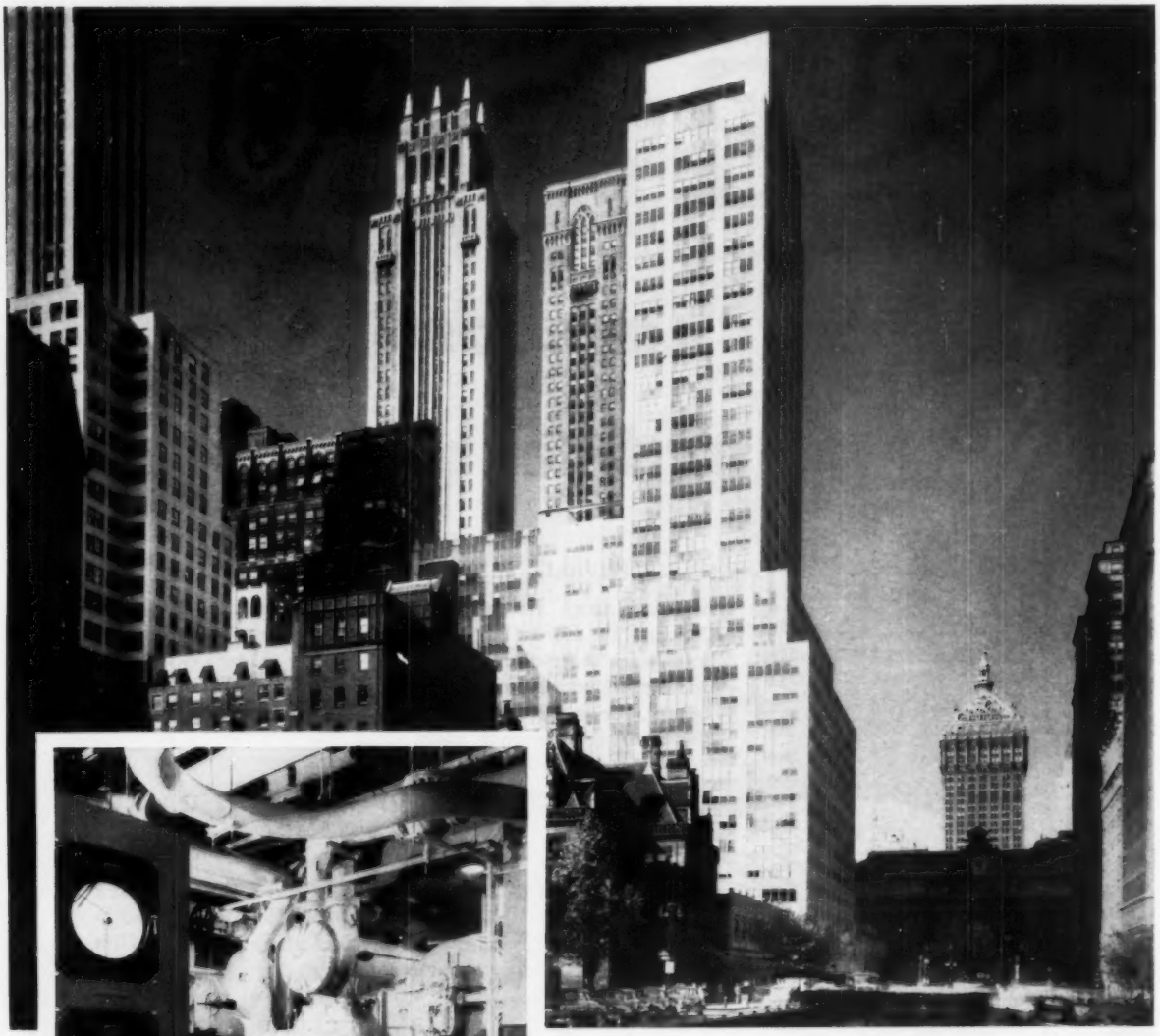
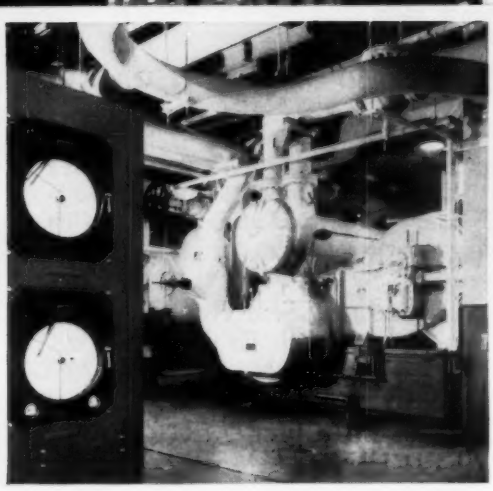
CITY _____ STATE _____





TAYLOR CONTROLLED Carrier SYSTEM MAKES THE SUN BEHAVE!

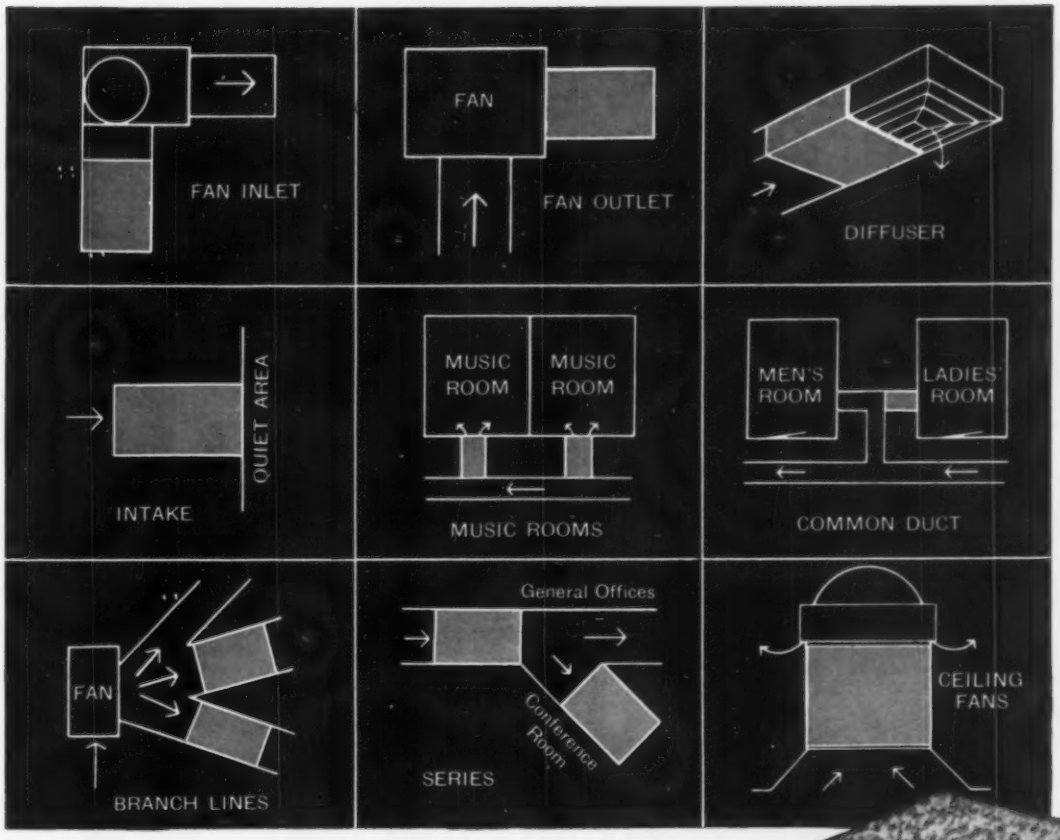
A BUILDING like 100 Park Avenue, which has many acres of glass wall area, is strongly affected by the heat of the sun. And since the solar factor is constantly changing with the sun's angle, the central air conditioning system must be extremely flexible, in order to keep each office in constant comfort.

Carrier Corporation solved this problem of flexibility with the use of a Taylor FULSCOPE* Recording Controller for each of their two centrifugal refrigerating machines. Each controller operates a valve, which varies the speed of the machine according to the output temperature of the chilled water. One pen records the output water temperature, and the other records the input temperature. Thus constant water temperature is maintained in the primary air conditioning system, regardless of the effects of sun and weather on the face of the building.

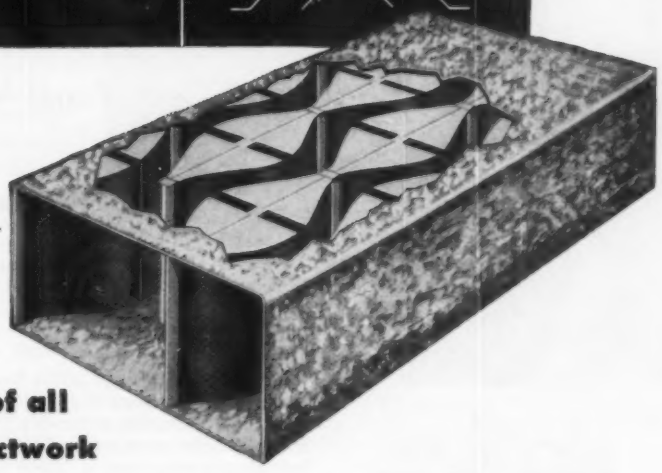
Whether you need air conditioning for human comfort or for product quality, Taylor Control will help you get top efficiency out of your equipment. Write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ontario.

*Reg. U.S. Pat. Off.

Taylor Instruments MEAN ACCURACY FIRST



Every Building Needs Aircoustat® Sound Traps



AIRCOUSTAT silences all noise of all frequencies traveling through ductwork

Eliminate disturbance, distraction and irritation caused by noises escaping from one area to another through ductwork.

Install AIRCOUSTAT Sound Traps. AIRCOUSTAT eliminates guesswork, wasted space and unnecessary expense of duct lining. You can guarantee your client trouble-free performance. You can estimate with complete confidence the performance of particular applications. If AIRCOUSTAT fits geometrically, it fits acoustically.

AIRCOUSTAT saves you space. Its greater effectiveness permits smaller-sized ducting. It eliminates bulky mufflers.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6202 Scott Street, Baltimore 3, Md.

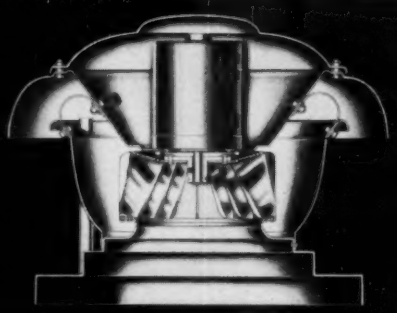
KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered Products Sold with *Service*

Quiet-Tested... Now Time-Tested...

OVER 50,000 CASE HISTORIES CAN'T BE WRONG!



Jenn-Air Quiet-Tested Centrifugal Direct Drive Roof Exhauster, with U-Spring Suspension Mounting. U-Springs suspend the power assembly, isolate it from the base. Noise caused by vibration is virtually eliminated.

Why U-Spring Cushion Suspension Mounting... by JENN-AIR... has now been adapted to JENN-AIR Axial Roof and Centrifugal Wall Exhausters

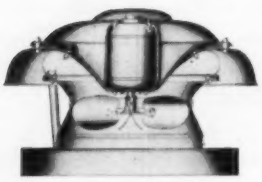
Jenn-Air Quiet-Tested Centrifugal Wall Exhauster, with U-Spring Suspension Mounting. Eliminates most duct work. Provides a means of ventilation through the wall.

The Facts: Two years ago Jenn-Air incorporated U-Spring Cushion Suspension Mounting in its Quiet-Tested Direct Drive Roof Exhausters. Since then, over 50,000 units have been installed.

The Facts: Not a single failure has been reported. No breakage on record. No instance of shipping damage (wheel binding into inlet), a common occurrence in rubber insulated ventilators . . . Jenn-Air U-Springs absorb the shock of rough handling. Only six recorded cases in 50,000, where the U-springs failed to solve the noise problem.

The Facts: U-Spring Cushion Suspension Mounting—which shows 44% less vibration transmission than rubber or neoprene—has now been adapted to Jenn-Air Axial Roof and Centrifugal Wall Exhausters. Another in the long line of Jenn-Air "firsts" that includes: *first* with *true* low contour design . . . *first* with spun aluminum construction . . . *first* with Quiet-Testing in Jenn-Air's exclusive Sound-Elec Test Chamber . . . *first* with motors lubricated for ten years of normal operation.

The Facts explain why you can look to Jenn-Air for quality-engineered exhausters that never wait for the rest of the field to catch up.



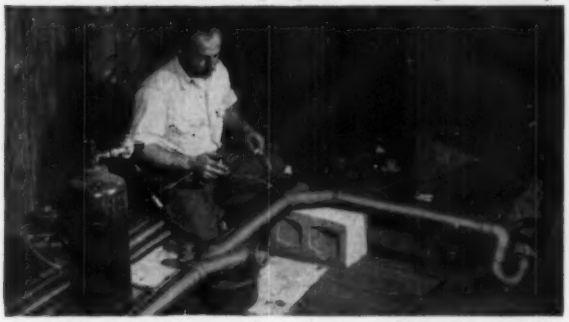
Jenn-Air Quiet-Tested Axial Roof Exhauster, with U-Spring Suspension Mounting. Recommended for general ventilation work and duct-type application.

JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive, Indianapolis 7, Indiana
MEMBER, AIR MOVING AND CONDITIONING ASSOCIATION

MOTEL OWNER EXPLAINS WHY

ALL-COPPER PLUMBING IS A SOUND BUSINESS INVESTMENT

The new 24-unit, 2-story "3 Judges" Motel, just off the famous Wilbur Cross Parkway, at New Haven, Conn. Architect, Caproni Associates, New Haven; consulting engineer, R. S. Leigh, Woodbury; plumbing contractor, J. V. Ursini Co., New Haven.



The light weight of copper tube makes it possible to pre-assemble sections. Units like this, or even larger, can be handled and set in place easily.

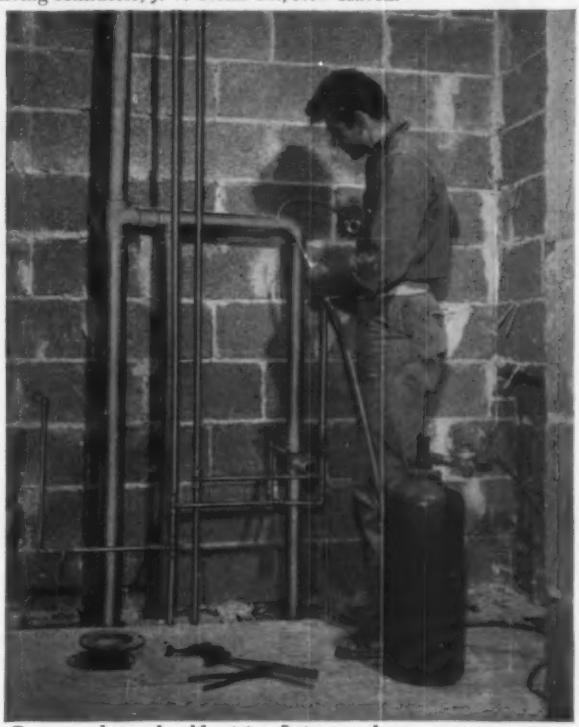
"SOUND, but economical, construction and low maintenance cost are two important factors in achieving reasonable returns from an investment in the motel business," says Stephen Nichols, owner of "3 Judges" Motel.

"That is why we wanted copper tube used for the plumbing, including all the sanitary drainage lines. We eliminate future repair and replacement expenses due to rust. With smooth copper tube there is much less chance of clogged lines. And we made savings in construction costs because extra wide plumbing walls were not needed."

OWNER, BUILDER, CONTRACTOR—all benefit when the use of copper tube for plumbing includes the sanitary drainage system and these benefits apply whether it is a commercial building, a housing development or a single home.

Plumbing contractors report that roughing-in is faster; their men like to work with copper for it is easier to handle and makes a neater job.

Builders say that by using the space-saving, trim copper tubes and compact solder-joint fittings they can locate bathrooms and utilities where desired without complicated and expensive construction to provide the extra space needed for the installation and maintenance of heavier and bulkier piping.



Copper tube and solder-joint fittings make a compact, space-saving installation. A 3" copper tube with fittings can be installed within a standard 4"-wide partition.

Owners have assurance of freedom from rust troubles, and homes with copper plumbing have higher resale values.

Anaconda Copper Tubes—Types K and L for water supply and heating lines; Type M and the new lighter weight Type DWV for the sanitary drainage system. Anaconda wrought and cast solder-joint fittings in types for pressure and drainage applications. Write for booklet—Anaconda Publication C-33. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

8704

ANACONDA® COPPER TUBES AND FITTINGS
Products of The American Brass Company
AVAILABLE THROUGH PLUMBING WHOLESALERS

B.F.Goodrich

Cell-Tite® Tubing saves Sheraton a cool $9,517.26

Philadelphia's new Sheraton boasts 8,100 feet of B. F. Goodrich Cell-Tite Tubing on water lines of 1,000 room air conditioners, and for good reason!

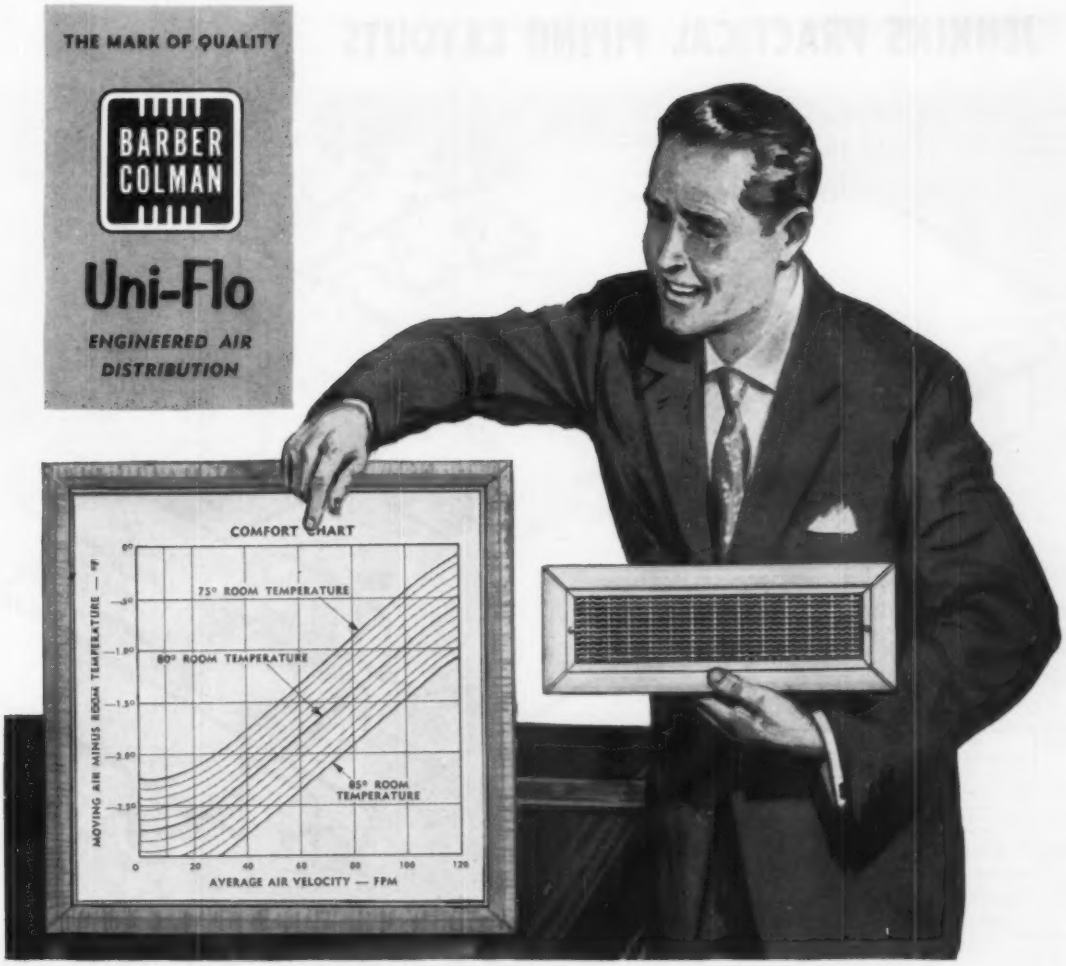
Saves labor costs: "With Cell-Tite Tubing," says Mr. Earle Baltz, executive of Achenbach & Butler, Inc. insulation specialists, "we cut the time needed to put insulation on two lengths of pipe from a normal three hours to only 20 minutes. This individual saving of two hours and forty minutes became a saving of 2,666 man-hours on the whole job. Labor on this costs $3.57 per hour — multiplied by the total time, making a saving of $9,517.26!"

Why they selected Cell-Tite: "Cell-Tite effectively prevents condensation on pipes carrying cold water through warm areas, holds heat of hot water in pipes. The material suffers no effects from constant exposure to maximum heat rating ... continually holds up under heats approaching its rated 220° resistance, has a K factor of 27 giving maximum insulation without undue thickness, is consistent and uniform in quality and assures even all-around insulation by being of 'closed-cell' construction."

Easy to install: "This tubing cuts labor costs by easy-threading on pipe, fits around bends, gives a much neater appearance. To strip the ends, we held the Cell-Tite Tubing back clear of the connection, held it in place with wire. After the connection was made, the wire was cut and the insulation moved over the exposed section. Even after being wired in a compressed position for two months, Cell-Tite showed no permanent set!"

Get free booklet: For complete information and free booklet on Cell-Tite Tubing, Strip and Cord, write B. F. Goodrich Sponge Products, a division of The B. F. Goodrich Company, 481 Derby Place, Shelton, Connecticut.

B.F.Goodrich
SPONGE PRODUCTS



"Precision-controlled* air distribution from sidewalls? Only through Barber-Colman's true sidewall diffusers."

Precision air distribution from sidewalls ceases to be a problem when you specify Barber-Colman Uni-Flo Sidewall Diffusers — designed to give adjustable air patterns and rapid diffusion without harmful airstream drop — *a true diffuser*, not merely a grille.

*The Barber-Colman *Comfort Chart*, above, shows proper relation between air velocities and air temperatures important to human comfort. Each curve represents limit of satisfactory conditions for an average room temperature — points above the line fulfill Human Comfort Standards. Tools like this chart, developed by Barber-Colman engineers, and Uni-Flo Sidewall Diffusers help you define and deliver ideal results. The surest, easiest way is with *combined* Barber-Colman Air Distribution and Automatic Controls.

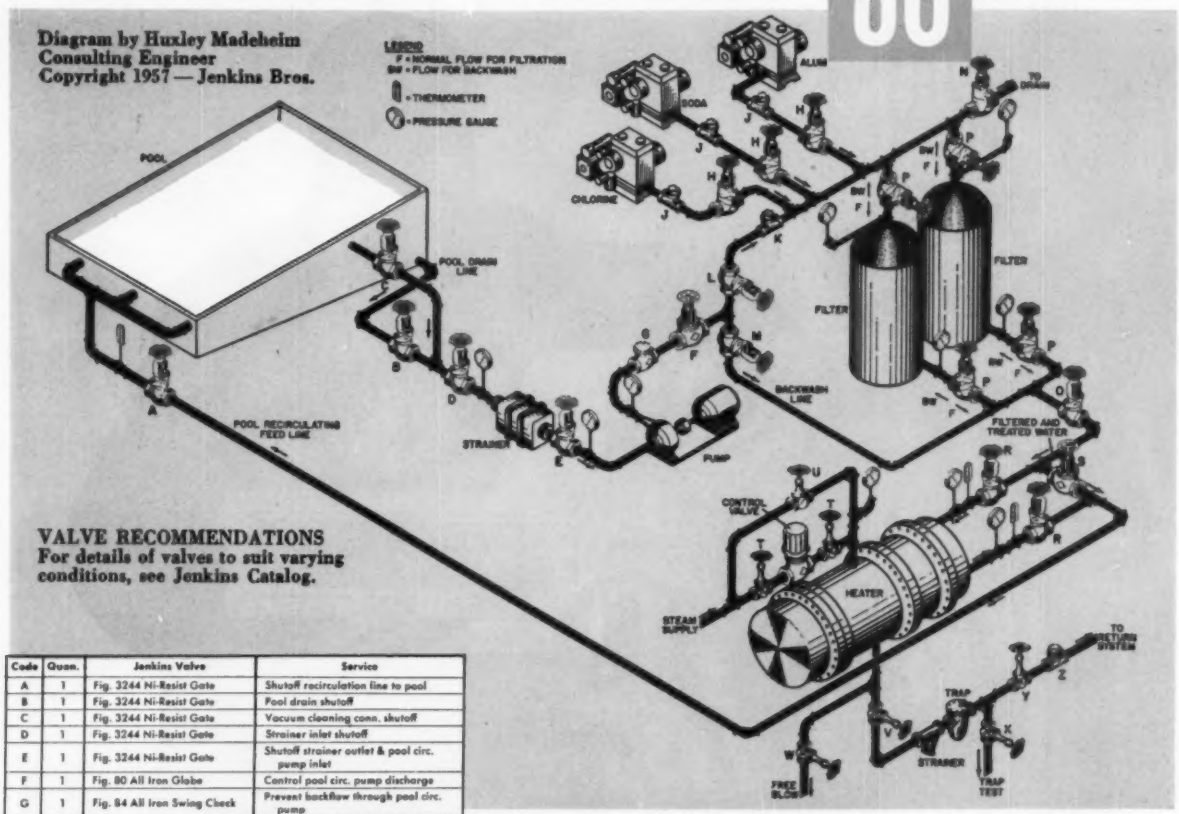
Request Uni-Flo Diffuser Catalog and other details from your nearby Barber-Colman Field Office or write . . .

BARBER-COLMAN COMPANY

Dept. B, 1101 Rock Street, Rockford, Illinois

JENKINS PRACTICAL PIPING LAYOUTS

80



VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 3244 Ni-Resist Gate	Shutoff recirculation line to pool
B	1	Fig. 3244 Ni-Resist Gate	Pool drain shutoff
C	1	Fig. 3244 Ni-Resist Gate	Vacuum cleaning conn. shutoff
D	1	Fig. 3244 Ni-Resist Gate	Strainer inlet shutoff
E	1	Fig. 3244 Ni-Resist Gate	Shutoff strainer outlet & pool circ. pump inlet
F	1	Fig. 80 All Iron Globe	Control pool circ. pump discharge
G	1	Fig. 84 All Iron Swing Check	Prevent backflow through pool circ. pump
H	3	Fig. 1312 or 1313 S. S. Globe	Control chemical treatment feeders
J	3	Fig. 1328 S. S. Swing Check	Prevent backflow to chem. treatment feeders
K	1	Fig. 1328 S. S. Swing Check	Prevent backflow of chem. treatment to pump & BW line
L*	1	Fig. 3244 Ni-Resist Gate	Shutoff pool flow to filters — Normal filtration
M*	1	Fig. 3244 Ni-Resist Gate	Shutoff pool flow to filters — Backwash cycle
N*	1	Fig. 1312 or 1313 S. S. Globe	Control flow to drain
O*	1	Fig. 3244 Ni-Resist Gate	Shutoff recirc. flow to heater & pool
P	4	Fig. 1302 S. S. Gate	Shutoff filters
R	2	Fig. 3244 Ni-Resist Gate	Shutoff pool water heater
S	1	Fig. 80 All Iron Globe	Control bypass flow about pool water heater
T	2	Fig. 47-U Bronze Gate	Shutoff steam supply control valve to pool water heater
U	1	Fig. 106-A Bronze Globe	Control bypass flow st. supply pool water heater
V	1	Fig. 47-U Bronze Gate	Shutoff steam trap
W	1	Fig. 546-P S. S. and Bronze Globe	Control free flow
X	1	Fig. 546-P S. S. and Bronze Globe	Control steam trap test
Y	1	Fig. 47-U Bronze Gate	Shutoff return system from trap
Z	1	Fig. 92-A Bronze Swing Check	Prevent backflow from return system

	*Normal Cycle Filtration	*Backwash Cycle Filtration
L	OPEN	CLOSED
M	CLOSED	OPEN
N	CLOSED	OPEN
O	OPEN	CLOSED

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864
Jenkins Bros.
Sold Through Leading Distributors Everywhere

How to plan piping connections

FOR A SWIMMING POOL WATER CIRCUIT

In this swimming pool water circuit, water is drawn off by a pump having a strainer to remove foreign matter. Water is treated with various chemicals to render it slightly alkaline; to kill bacteria and to inhibit growth of algae and coagulated suspended solids. Water is then filtered, warmed and returned to pool through inlets. No make-up water connection is shown because most codes require an independent supply.

In normal operation of the system, valves L and O are open while M and N are closed, which permits water passage through filters and prevents flow to drain. Closing valve R and opening valve S will bypass heater when desired. Steam to heater is controlled by thermostatic valve.

Filter cleaning by "back washing" is done by closing valves L and O, and opening M and N. Water is forced through filters in reverse direction, and discharged to drain. Pool may be emptied by closing valves M and P, and opening L and N.

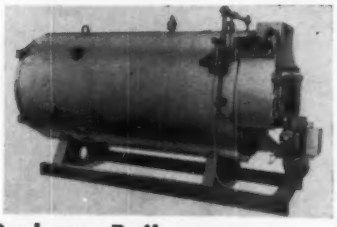
O. S. & Y. valves are recommended to prevent fluid action on spindle threads. All-Iron and Ni-Resist valves are specified for water circuit, and stainless steel valves where chemicals are encountered. Steam system valves are all-bronze or bronze with stainless steel trim.

Jenkins Fig. 240, and All-Iron, U-Bolt Gate, is used for shut-off control of flow to filters and heater. The solid iron wedge assures drop-tight closure, and the valve can be repacked under full pressure. Jenkins Fig. 1312 or Fig. 1313, Stainless Steel Globe Valves resist corrosion and are recommended for control of chemical and drain flow. The twin bolted bonnet and body design facilitates dismantling for cleaning and regrinding, and is especially suitable where chemicals might destroy conventional body-bonnet threading.

To assure efficiency when planning any major piping installation, consult accredited piping engineers and contractors. For prompt, capable help when you want Jenkins Valves and other supplies, call your local Jenkins Distributor. Jenkins Bros., 100 Park Ave., New York 17.

EQUIPMENT DEVELOPMENTS . . .

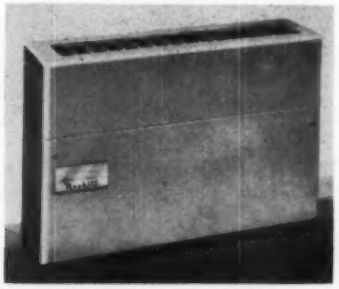
For reviews of Recent Trade Literature see Page 192



Package Boilers . . .

. . . in sizes 18 to 92 hp — *Kewanee Boiler Div., American Radiator & Standard Sanitary Corp., Dept. HPAC,* 101 *Franklin St., Kewanee, Ill.*

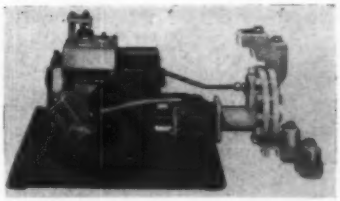
Units available in eight sizes of high pressure packages, 125 to 150 swp, 18 to 92 hp; eight sizes of low pressure packages, 15 lb steam or 30 lb water, 606,000 to 3,060,000 Btu per hr. Completely automatic forced draft firing is cited feature of new units. Burners facilitate complete carbureting of No. 5 oil and — on combination gas, oil firing — quick fuel changeover by simple valve control, says company.



Air Conditioning Units . . .

. . . designed for hospitals, offices, showrooms, churches, hotels, motels — *John J. Nesbitt, Inc., Dept. HPAC, State Rd. and Rhawn St., Philadelphia* 36.

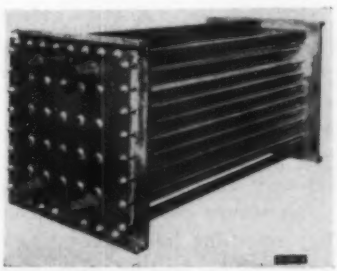
In five largest "Roommate" units, bypass capacity control provides closer summer humidity control, lowers pumping requirements, manufacturer says. Those with outdoor air openings have air volume stabilizers designed to save fuel costs, increase comfort. Available in seven basic sizes providing cooling capacities 17,500 to 111,000 Btu per hr. Units may be floor, wall, ceiling mounted with selection of nonrecessed, semi-recessed, fully recessed, universal, built-in arrangements.



Volume Diaphragm Pump .

. . . for metering toxic, obnoxious, corrosive, costly chemicals — *Milton Roy Co., Dept. HPAC,* 1300 *E. Mermaid Ln., Philadelphia* 18.

New units have teflon diaphragms sealing liquid ends from plunger and housing. Plunger displaces hydraulic fluid which in turn strokes diaphragm to impact pumping action through double ball checks. Available with maximum capacities 1.1 to 138 gph, pressures to 2000 psi. Manual, automatic capacity adjustments are zero to 100 percent.



Heat Exchange Coils . . .

. . . designed for operation in process industries — *Niagara Blower Co., Dept. HPAC,* 405 *Lexington Ave., New York* 17.

Units made of aluminum; copper; stainless, carbon, alloy steel; hot dipped galvanized steel. Both prime surface, extended surface types manufactured. Included are series flow, serpentine, parallel flow, cleanable, partitioned, bended coils. Units for pressures to 3000 lb also available.

Immersible Motor . . .

. . . designed for submerged operation — *Louis Allis Co., Dept. HPAC,* 427 *E. Stewart St., Milwaukee* 1.

Unit may be close coupled to agitators, pumps in sewage sumps, chemicals, water, abrasive industrial oils, company says. Motor shaft directly attached to impeller; motor, pump can be raised, lowered into position together by means of motor's lifting lugs. Among features cited: leaktight construction, neoprene breathers, waterproof cable connection, corrosion resistant parts. Available in ratings ¾ to 40 hp, both single and polyphase.

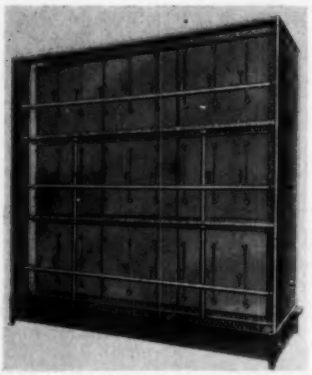
Diversion Fitting . . .

. . . for either supply or return — *Bell & Gossett Co., Dept. HPAC,* 8200 *N. Austin, Morton Grove, Ill.*

New "Red-Wing" replaces fittings used separately for supply, return purposes. Since it combines two kinds of fittings in one, reduced inventory requirements result.

EQUIPMENT DEVELOPMENTS

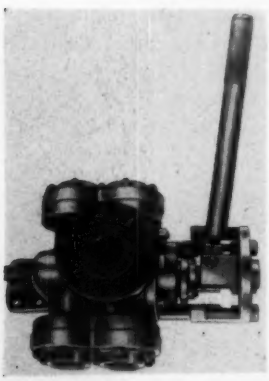
Continued



Sprayed Coil Dehumidifiers

. . . designed for built-up comfort, process cooling systems — *Trane Co., Dept. HPAC, La Crosse, Wis.*

New units adaptable for applications requiring precision humidity control, company says. Basic components include coils, spray nozzle assemblies, heavy gage eliminators, corrosion resistant vertical casings. Two models in 36 sizes available. One has coil sections mounted together, secured by one piece side panels. Another has sectionalized side supports for removal when coil inspection is desired. Capacities range 2500 to 41,000 cfm.



Transfer Valve . . .

. . . designed for duplexing two strainers, heat exchangers, other equipment where fast, smooth transfer of flow from one unit to another is required — *A. W. Cash Co., Dept. HPAC, Box* 551, *Decatur, Ill.*

Type "45" unit has six ports including common inlet and outlet. Flow is through single inlet to either of two pieces of equipment and out common discharged connection. Transition of flow from one unit to another on proportional basis provided by engineering feature, company says. Single operating handle jacks up plug before rotation. Available in two sizes: 1 in. 600 lb flanged, 1½ in. 150 lb flanged.

Snap-On Pipe Insulation . .

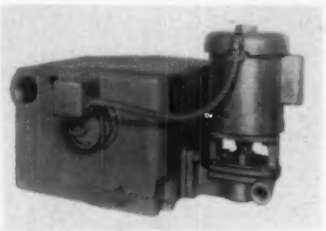
. . . designed to simplify insulating of industrial piping — *Delaware Insulation Co., Fifth Ave. and Colman St., Wilmington, Del.,* and *Urethane Foam Div., Rainbow Industries, Inc., Butler, Pa.*

New material has service range −200 to 250 F; available in variety of sizes, shapes, thicknesses for conventional piping and fittings. Made of resilient urethane foam, product said to have thermal conductivity of 0.29 and—at 75 F—tensile strength of 30 psi. Insulation will not support combustion, can be stretched as much as 190 percent, will mesh together tightly, company says. One of raw materials of product is "Hylene," manufactured by E. I. du Pont de Nemours & Co.

Weather Report System . .

. . . designed to measure, indicate speed and direction of wind, temperature, relative humidity, rainfall, barometric pressure — *Friez Instrument Div., Bendix Aviation Corp., Dept. HPAC, Taylor Ave., Towson, Baltimore* 4.

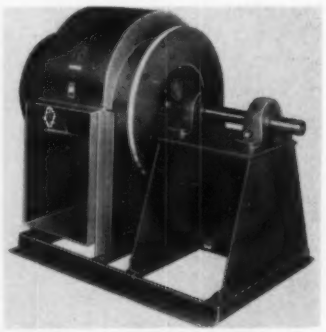
New system consists of six units. They are: wind indication unit with transmitter to measure wind speed, wind direction simultaneously over range 2 to 100 mph; temperature unit which measures temperature from −20 to 120 F; barometric pressure unit that measures pressure 26 to 32 in. of mercury; relative humidity unit; rainfall unit. Weather data presented indoors on 11 in. diameter color dials.



Condensate Pump . . .

. . . with 12,000 sq ft EDR rating — *Hoffman Specialty Mfg. Corp., Dept. HPAC,* 1700 *W.* 10*th St., Indianapolis* 7.

Model "WC 12-20" has cast iron receiver, bronze fitted centrifugal pump, stainless steel pump shaft, 1/3 hp motor, low inlet. Unit has pump capacity of 18 gpm, discharge pressure of 20 psi, receiver capacity of 14 gal. Features cited by manufacturer: durability, high efficiency, ruggedness, quietness of operation.

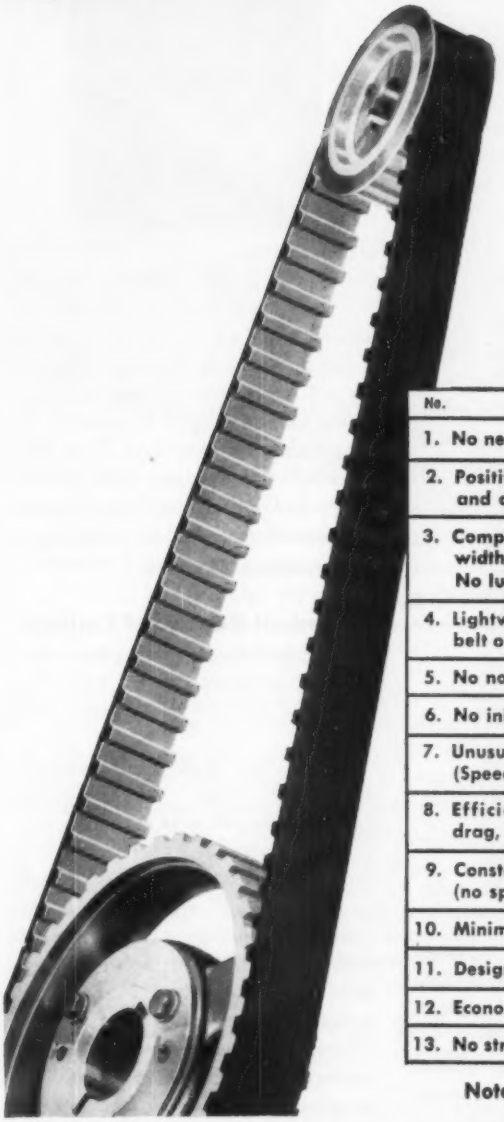


High Temperature Fans . .

. . . with bearings kept in cooler operating zones — *General Blower Co., Dept. HPAC,* 8611 *Ferris Ave., Morton Grove, Ill.*

Rotating member of dissimilar alloy — fitted to shaft — radiates, circulates ambient heat away from bearing areas, manufacturer says. Product line runs 600 to 30,000 cfm, will handle temperatures ranging to 1650 F. Among other features cited by company: simplicity of design, easy field erection, economical maintenance, long service life.

US RUBBER *PowerGrip* "TIMING" BELTS



This "check chart" shows why *PowerGrip* Distributors have such a vigorous growth in profits

No. Advantages	PowerGrip "Timing" Belt	Chain	Gear	V-Belts	Flat Belts
1. No need for lubrication	✓			✓	✓
2. Positive elimination of slip and creep	✓	✓	✓		
3. Completely compact (Both in width and pulley diameter) No lubrication housing.	✓				
4. Lightweight (Heavy duty belt only 0.1 lb./ft./in.)	✓				
5. No noise or vibration	✓			✓	✓
6. No initial tension	✓	✓	✓		
7. Unusual speed range (Speeds up to 12,000 FPM)	✓				
8. Efficient (Elim. heat, lube drag, high bearing loads)	✓				
9. Constant angular velocity (no speed fluctuation)	✓				
10. Minimum backlash	✓		✓		
11. Design flexibility	✓				
12. Economical	✓				
13. No stretch	✓		✓		

Note: "check chart" based on normal transmission requirements

Use U. S. PowerGrip "Timing"® Belts as your power transmission leader—because they take a "✓" after *every* advantage.

While every type of drive has certain advantages, *no* type of power transmission possesses *so many* advantages as the PowerGrip "Timing" Belt drive—made by U. S. Rubber, the originator of this unique drive.

THE LIST OF USES GROWS DAY BY DAY! Power production machinery in every field is made more efficient, volume of production increased, and maintenance costs lowered with this amazing belt. The list of OE applications grows too numerous to mention. U. S. PowerGrip has streamlined hundreds of products... made them sell above competition. Some equipment would not be in existence at all, if it weren't for this great belt.

U. S. PowerGrip "Timing" Belt drives—from fleapower to 1000 h.p., and with ratios up to 12 to 1—are the "hottest" transmission belt sellers of the decade! For complete information, contact a power transmission specialist at any of the 28 "U.S." Branch Warehouses or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

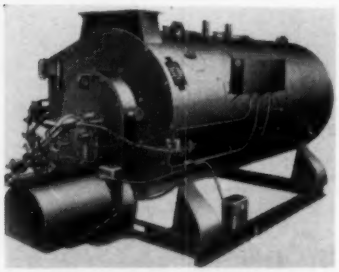
Mechanical Goods Division

United States Rubber

See things you never saw before. Visit U. S. Rubber's new Exhibit Hall, Rockefeller Center, New York 20, N.Y.

EQUIPMENT DEVELOPMENTS

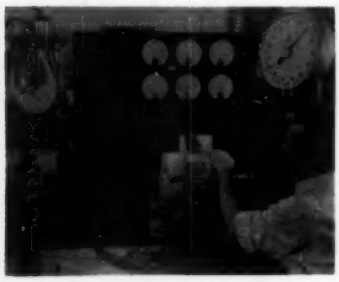
Continued



Hot Water Generators . . .

. . .designed for hot water heating systems — *Cyclotherm Div., National-U.S. Radiator Corp., Dept. HPAC,* 157 *E. First St., Oswego, N. Y.*

Units supply capacities ranging 670,000 through 6,700,000 Btu per hr for standard forced circulation hot water systems. Other models available for high temperature operation, systems requiring larger capacities. Among features cited by manufacturer: 80 percent efficiency, minimum installation costs, minimum space requirements. Units may be operated with variety of fuels. High temperature limit controls have been added to protect unit and equipment of hot water system.



Motors . . .

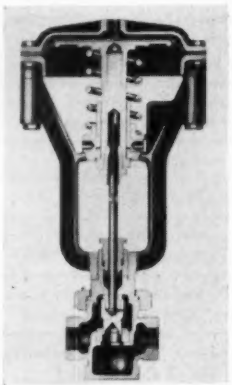
. . .in sizes 1/3 to 800 hp — *A. O. Smith Corp., Dept. HPAC,* 3533 *N. 27th St., Milwaukee.*

Included in new product line are: enclosed 1 to 500 hp models said to be explosionproof, splashproof; blower motors 1/3 through 3 hp; hermetic motors 3/4 to 100 hp; hermetic units 1800 or 360 rpm with 3/4 to 20 hp. Other new models are fractional motors 1/3 to 1 hp capacitor start, polyphase induction; single phase integrals 1 to 5 hp; gear motors 1 to 25 hp.

Air Conditioning System . .

. . .with selfcontained units for installation in multistory buildings — *Carrier Corp., Dept. HPAC,* 300 *S. Geddes St., Syracuse* 1.

Heart of new system is utility core consisting of cooling tower, electrical and water supply. Individual units are placed in operation over period of several years. Calculation of building's total cooling requirements, location of individual "Weathermaker" units, centralization of utility service, sequence of equipment placement covered in company's air conditioning plan. Once cooling tower, necessary utility core have been installed, piping, wiring to site of each unit is completed; then actual installation work of units may begin, manufacturer says.



Control Valve . . .

. . .designed for instrument actuated control of temperature, pressure, flow — *Sinclair-Collins Valve Co., Dept. HPAC,* 454 *Morgan Ave., Akron* 11.

Diaphragm operated unit offered in both direct, reverse acting types for steam, air, liquid, gas service to 250 psi. Available in sizes 1/16 through 2 in., direct acting; 1/8 through 2 in., reverse acting. Tapered variable port area designed for accurate regulation of temperature, pressure, flow, company says.

Thermometer Kit . . .

. . .designed for checking super heat —*Marsh Instrument Co., Dept. HPAC, Skokie, Ill.*

New kit consists of two identical 2 in. dial thermometers in polished brass cases having screwed rings,

bevelled glass crystals. Dials graduated −40 to 65 F. Each thermometer equipped with 12 in. double armour capillary tubing, small sensitive bulb 1/4 in. in diameter. Ring at top of thermometer case provides means of attaching it to whatever is convenient, company says. Two nonabsorbent, oil resistant, foam rubber wrappers for attaching bulbs to points of measurement, for insulating them from ambient temperature included.

Chemical Resistant Linings

. . .designed for severe process service — *Corrosion Control Co., Inc., Dept. HPAC,* 516 *Fifth Ave., New York* 36.

Linings are high solids materials formulated with chlorosulfonated polyethylene polymers. They are supplied exclusive of primer in two basic formulations — a one part packaged material recommended for fumes and spillage, of moderate duration, concentration; a two package system, consisting of base, curing agents recommended for severe fumes, spillage, immersion service under severe conditions. Both are thermosetting materials that vulcanize at room temperature to tough, thick, resistant and resilient elastomeric linings, ready for heavy duty service, company says.

Guarded Hot Plate . . .

. . .for measurement of *K* factor of all high, moderate temperature materials within temperature range 100 to 1400 F — *Testing Equipment Sales Co., Dept. HPAC, Murray Hill, N. J.*

Equipment uses cold surface heaters which increase mean tempera-

(*Continued on page* 170)

"I cut welding time when

B&W Welding Fittings

are specified!"

"From my own experience, I know that B&W Welding Fittings are dimensionally accurate and fit-up fast and positive. Welding time is reduced and one can make a trouble-free permanent joint. That means lower piping costs."

THE dimensional accuracy of B&W Welding Fittings makes a welder's job easier and helps to make his work more precise. Trouble caused by poor fit-up to pipe is eliminated. Every fitting has true circularity, full radius and walls of uniform thickness, which result in time saved in installation, top-quality joints, and helps to achieve a permanent, leak-proof, piping system. Write for bulletin FB504.

B&W Welding Fittings and Forged Steel Flanges are available in a complete range of types and sizes in carbon steel and the B&W CROLOYS.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
3839 WEST BURNHAM STREET • MILWAUKEE 46, WISCONSIN

THE *NATURAL* SOURCE FOR ALLOY FITTINGS

B&W

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Seamless welding fittings and forged steel flanges, seamless and welded tubular products, solid extrusions — in carbon, alloy, stainless steels and special metals.

Mr. Mulligan solves his warehouse problem

I WISH MANUFACTURERS WOULD SELL US SMALLER QUANTITIES
COME OVER TO THE WAREHOUSE — THERE'S A TRUCK FULL OF VALVES FROM XYZ MFG. CO., AND I DON'T KNOW WHERE TO PUT THEM

THEY'VE GOT TO GO SOMEWHERE WE MAY NEED THEM. HOLD ON— I'LL BE RIGHT OVER
MULLIGAN REFRIGERATING CO. P. MULLIGAN President
OHH!
LISTEN, MAC—I'VE GOT TO GET RID OF THIS STUFF
NO! NOT IN MY BASEMENT. IT'S FULL NOW WITH THAT LAST ORDER OF PIPE, REMEMBER?
FRAGILE
TO WAREHOUSE
DELIVERY SLIP
PURCHASING AGENT
OK. WE'LL BUILD A BIGGER WAREHOUSE
FRAGILE
OVER HERE... OOPS!
MULLIGAN REFRIGERATING CO. WAREHOUSE UNDER CONSTRUCTION

Buy from your complete air conditioning and refrigeration wholesaler—your handy warehouse for every air conditioning and refrigeration need
WHO NEEDS A WAREHOUSE NOW? STOP THE MACHINERY!
ABC REFRIGERATION SUPPLY CO? SEND OVER SIX XYZ VALVES— WE NEED THEM THIS AFTERNOON
THIS IS MORE LIKE IT
COMPLETE AIR CONDITIONING & REFRIGERATION WHOLESALER
HEADQUARTERS FOR FREON REFRIGERANTS

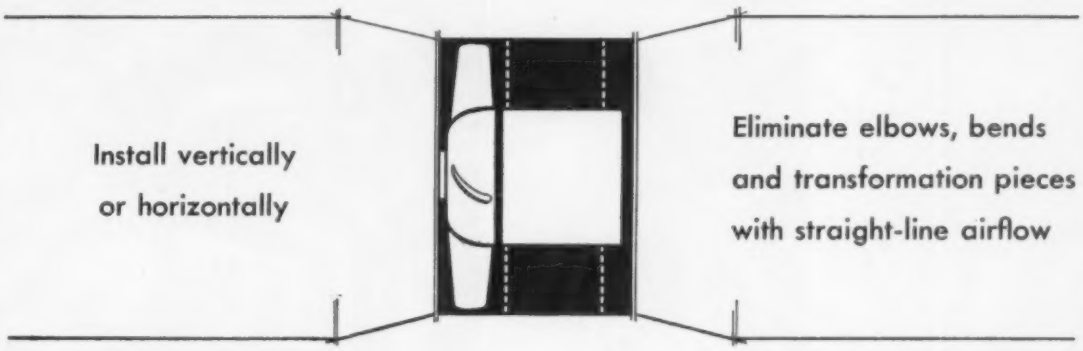
PROVED DEPENDABLE... When you need a refrigerant, be sure to see your complete air conditioning and refrigeration wholesaler... and then be sure you *always ask for "Freon"**. Choose "Freon" and you choose a refrigerant backed by more than 26 years of Du Pont technical and manufacturing leadership. Choose "Freon" and you choose a refrigerant that sets the industry's standard for purity and dryness.

Buy where you see this sign . . .

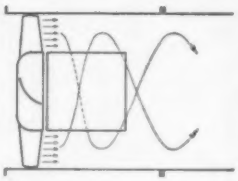
DU PONT REG. U. S. PAT. OFF. **FREON** REFRIGERANTS

BETTER THINGS FOR BETTER LIVING... *THROUGH CHEMISTRY*

*"*Freon*" *is Du Pont's registered trademark for its fluorinated hydrocarbon refrigerants.*

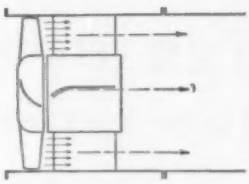


Large-diameter hub and die-formed blades insure uniform air velocity from hub to tip.



TUBEAXIAL

Air discharge follows a spiral path, then straightens out a short distance from fan at moderate pressures.



VANEAXIAL

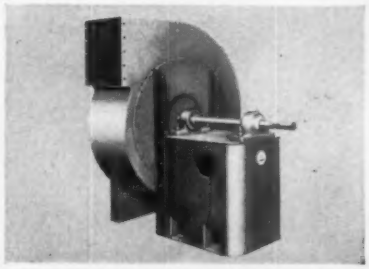
Air discharge is transformed into useful energy by directional guide vanes, increasing efficiency, pressure.

American Blower axial fans deliver the volume you need; fit the space you have!

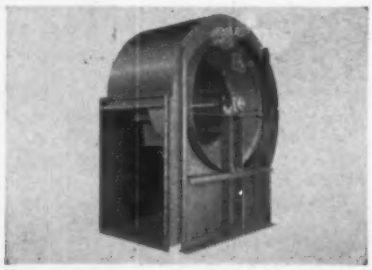
Whatever your air-moving problem – ventilating, heating, drying or processing – you'll find an economical solution in the complete line of precision-built American Blower fans. *Plus-value:* Rugged construction of every American Blower fan gives you extra years of low-cost service with minimum maintenance.

Seventy-three American Blower branch offices from coast to coast – are staffed by skilled sales engineers. Ask them to help you select the right equipment for *your* job. Call today! American-Standard, American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

It pays to standardize on American Blower fans for every duty!



Industrial Fans—three wheel-options



HS Fans – nonoverloading, minimum power

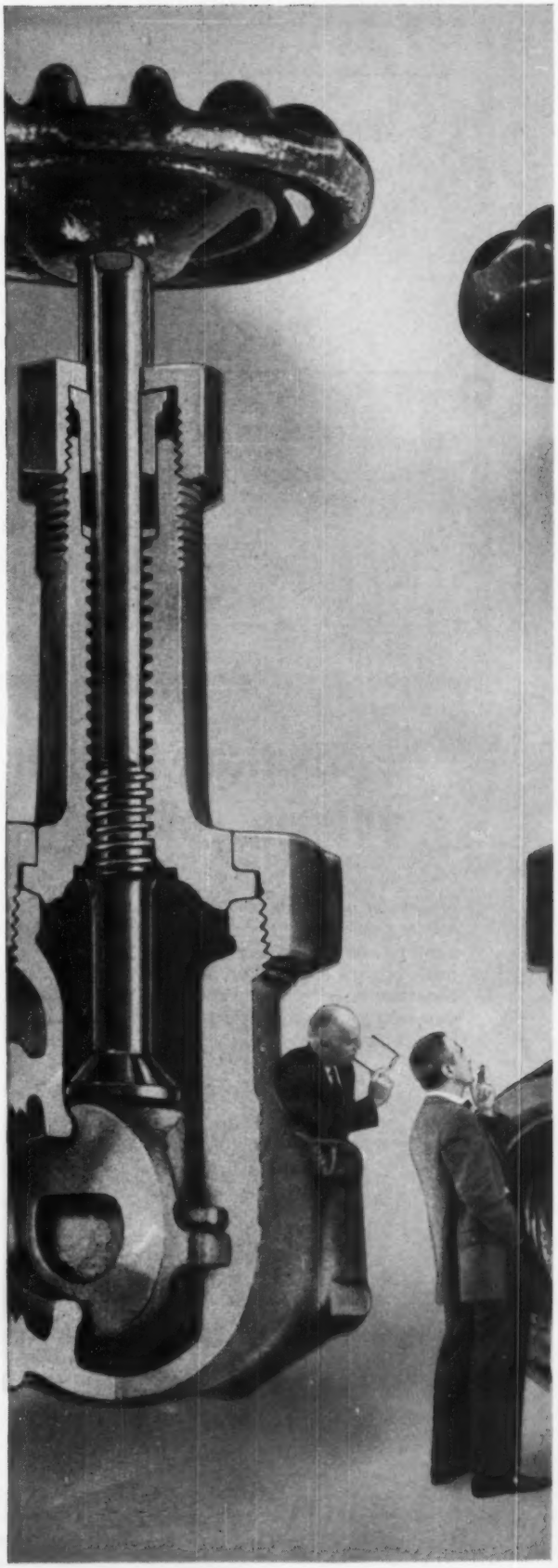
Sirocco Fans—low speed, quiet operation

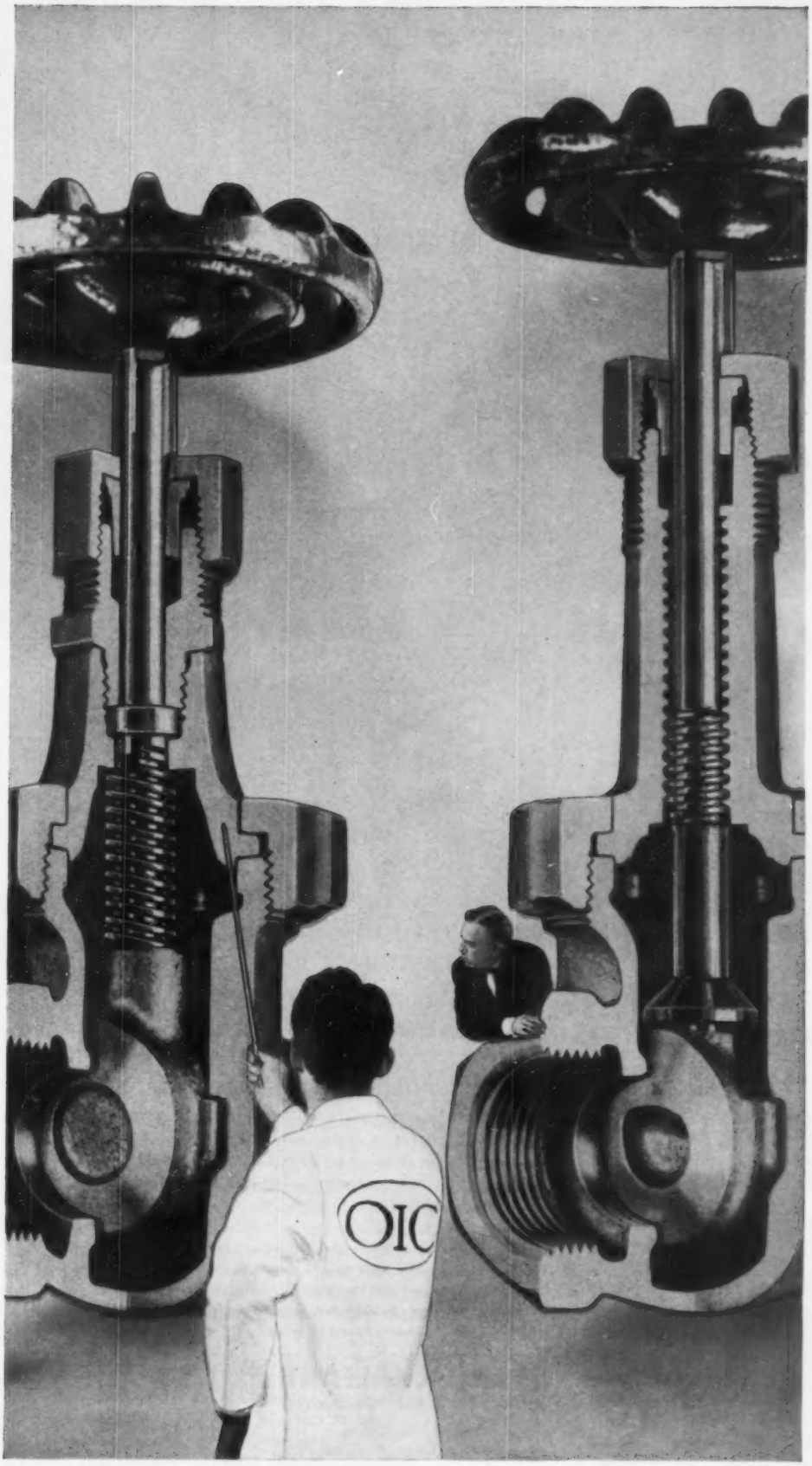
AMERICAN-Standard
AMERICAN BLOWER DIVISION

-three gate
valve types
in three
pressure classes-

all with safe efficient
union bonnet joints

OIC VALVES
BRONZE, IRON, FORGED AND
CAST STEEL LUBRICATED PLUG VALVES





No matter how far you look, this is the most complete *modern* line of bronze gate valves you'll find anywhere. All, of course, feature OIC *alloy-40* stems which ordinarily last for the life of the valve.

125-lb., 150-lb., 200-lb. pressure classes. Solid or split wedges, rising or non-rising stems. Call your OIC Distributor for quick service. Or write for specification literature.

THE OHIO
INJECTOR COMPANY
Wadsworth, Ohio

ANOTHER

SPANG®

CW STEEL PIPE

INSTALLATION

Glazing operation requires both water and compressed air. 4,000 ft of SPANG Pipe comprise water lines, 1,000 ft carry compressed air.

Dewey W. Hall, Hall Plumbing & Heating Co., inspects the compressed air system at Stylon Southern Corporation. 5,000 ft of Spang Steel Pipe, in sizes from ¾" to 12", were installed at Stylon Plant No. 2.

Dependable past performance creates second SPANG® Steel Pipe order at Stylon Southern Corporation

The new $2,000,000 Plant No. 2 of Stylon Southern Corporation at Florence, Alabama contains 5,000 ft of SPANG Steel Pipe to carry water and compressed air for the manufacturing of ceramic tile.

"With the new plant's capacity calling for the production of eight million square feet of ceramic tile a year, we must have reliable air and water piping to produce at this rate and operate efficiently," reports Mr. Robert C. Jackson, Plant Engineer.

"Based on our experience with a similar SPANG Pipe installation at our Plant No. 1 in 1954, we chose SPANG again for its dependability. The new installation, put into use in July, 1956, has performed perfectly."

Produced in a complete range of styles, sizes and colors, Stylon Ceramic Tile is used for walls, floors and counters in home and commercial applications. Combined, Plants No. 1 and No. 2 produce 15 million square feet of ceramic tile yearly. And SPANG Pipe plays a vital part in maintaining this production.

QUALITY CONTROL PROVIDES DEPENDABILITY

SPANG Steel Pipe is *quality-controlled* from skelp to finished product. Each lot is tested and inspected to bring you *top-quality* pipe that is easy to cut, bend and weld. There's a SPANG Distributor near you. Let him serve you on your next piping job.

Architect: Turner & Northington, Florence, Ala.
General Contractor: Brice Construction Company, Birmingham, Ala.
Piping Contractor: Hall Plumbing & Heating Company, Florence, Ala.
Spang Distributor: Tallman Supply Company, Florence, Ala.
Mechanical Engineer: Robert C. Jackson.

SPANG-CHALFANT SPANG®
DIVISION OF THE NATIONAL SUPPLY COMPANY CW STEEL PIPE

General Sales Offices:
Two Gateway Center, Pittsburgh, Pa.

District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

HALSTEAD & MITCHELL ENGINEERS PROVE . . .

A 100-TON COOLING TOWER CAN BE QUIET

HERE ARE TWO, NEW LARGE SIZES ADDED TO HALSTEAD & MITCHELL'S COMPETITIVELY-PRICED EC COOLING TOWER LINE

THE EC LINE. The addition of the 80- and 100-ton capacity towers extends the range of the more-value-per-dollar EC line. All 12 models, 5 to 100 tons, have outstanding features never before offered in this price group.

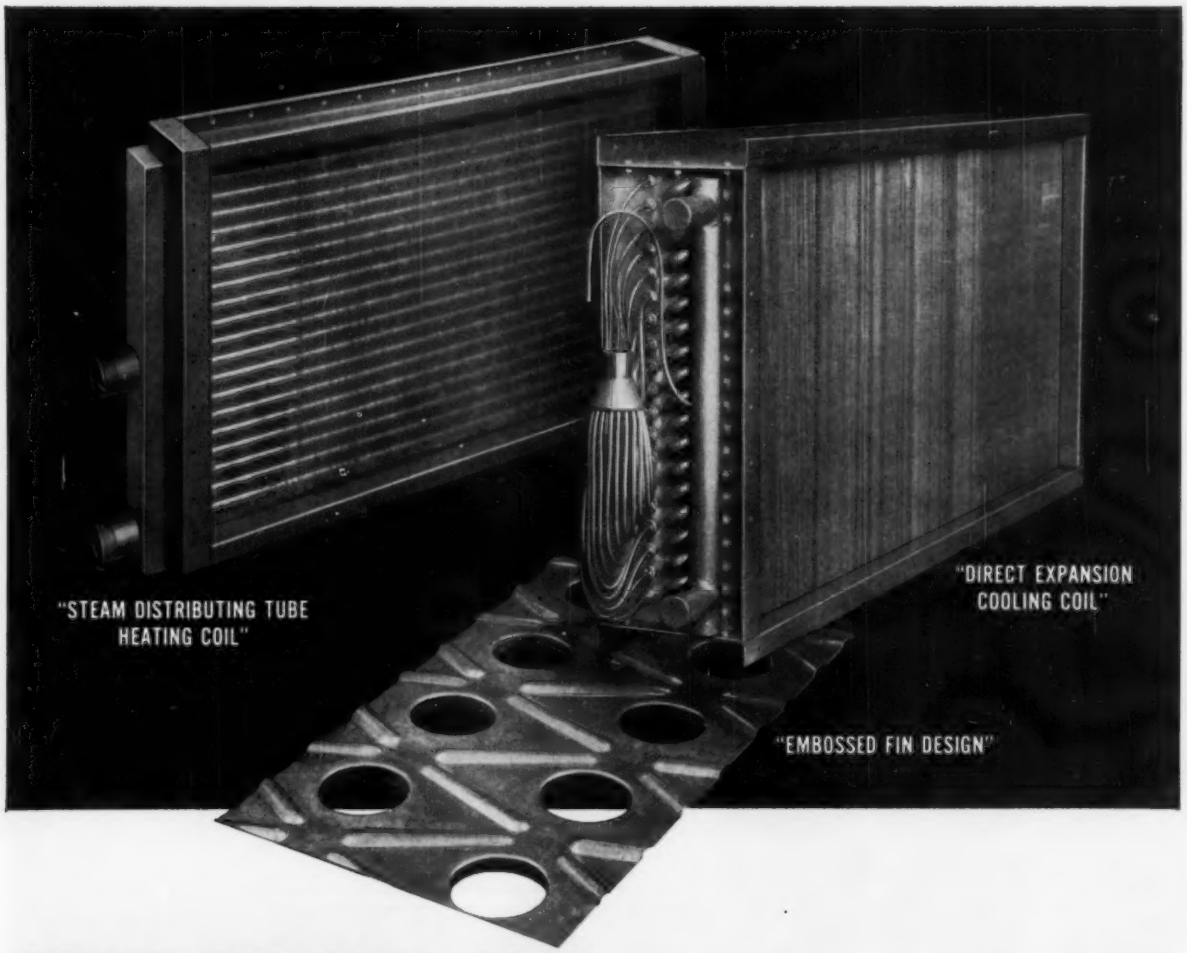
These include increased corrosion resistance due to rugged, 14-gage steel cabinets (12-gage sumps on the largest sizes) —weatherized by application of Vinsynite, Vinyl Zinc, and Chlorinated Rubber coatings. Exclusively, H&M offers pressure-creosoted wetted deck surfaces with the industry's only 20-Year Guarantee against rotting or damage due to fungus attack. New, sealed fan bearings are lubricated for life. Gravity-type distributing pans reduce pumping head, and cut down windage losses. Sump water levels are automatically controlled by integral float valves.

QUIET. Large diameter, four-bladed, deep pitch fans are belt-driven at low speeds by special weather and splash-proof motors. The EC-80 and EC-100 are driven at speeds of only 400 and 450 RPM. They're really quiet! Twin fans and drives power the three largest sizes, and all fans are of zinc plated, chromate dipped mild steel.

EC Series Cooling Towers are available in capacities of 5 thru 100 tons in standard, factory assembled models, or as Take-Aparts (ECK Series) for difficult-to-get-at installations. Residential, direct-drive ECD Series, with all the custom features and also competitively priced, come in capacities of 2 thru 7½ tons. Call your nearest Halstead & Mitchell wholesaler for delivery and prices or write: *Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.*

WRITE FOR COMPLETE DETAILS

HM Halstead & Mitchell



DEAD AIR IS A DUD... *and a costly one!*

Dead-air film on smooth fin surface prevents maximum heat transfer!

GET PURCHASED PERFORMANCE! . . . Use Westinghouse Heat Transfer Surface with its air-activating fin design—prevents dead-air film!

All Westinghouse Continuous Plate-fin Coils feature:

- **Embossed Fin design—Maximum Heat Transfer**
- **Permanent Mechanical Bond—Fin to Tube**
- **Minimum Air Resistance**
- **Guaranteed Published Performance**
- **Wide Selection—For Heating and Cooling**

And for Heavy Duty—Industrial-Process and High-Pressure applications . . . standard sections with extra-heavy wrought iron finned pipe!

Call your Sturtevant Division Sales Engineer for complete details on your heating and cooling coil requirements, or write Westinghouse Electric Corporation, Department K-14, Hyde Park, Boston 36, Massachusetts.

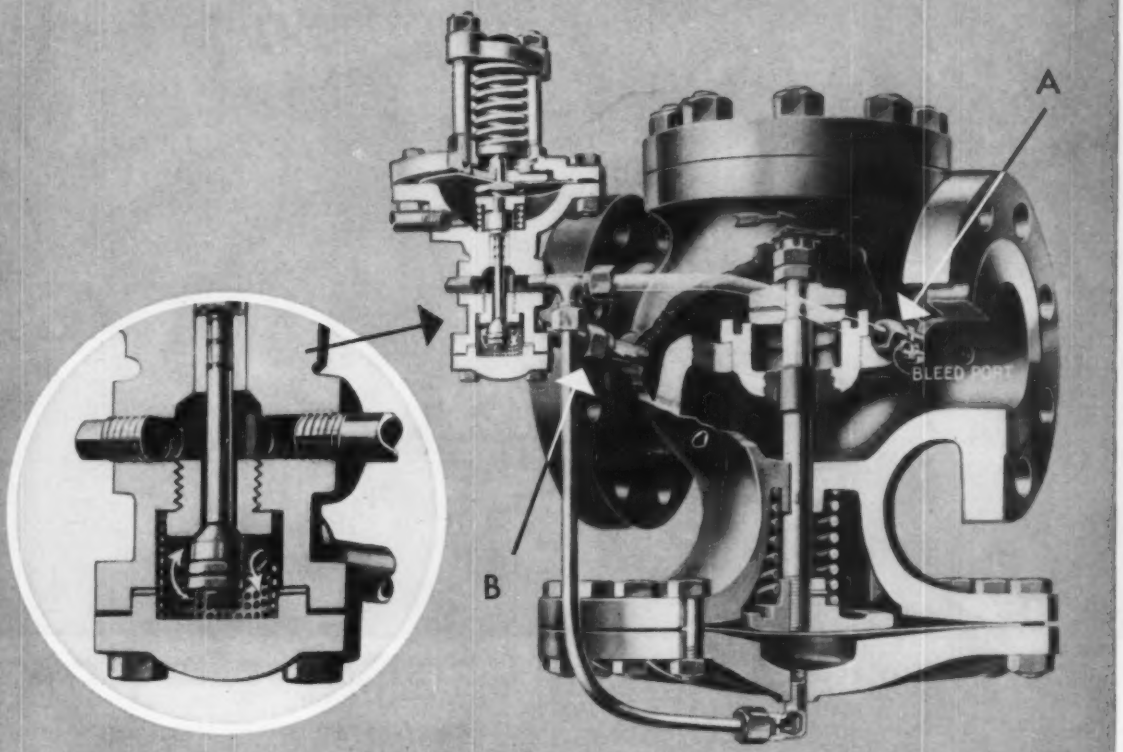
J-80635

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S Westinghouse

VALVE TIPS:

Advantages of External Pilots in Automatic Regulating Valves



Spence Type ED Pressure Regulator

"Maintenance-free, trouble-free, install-and-forget." They're all pretty phrases, but every engineer knows from experience they don't apply to regulating valves. Any valve designed to control temperatures or pressures within tight limits can be affected by dirt or other foreign matter in steam lines.

One advantage of the external pilot mounting shown above is simplified maintenance. Trouble shooting is faster, downtime is reduced, and tempers don't take such a beating. Here's why:

If trouble develops, it's easy to find out if it's in the pilot or the main valve. Just remove the tubing bend at A. A simple test, without any instruments or other equipment, shows where the trouble is.

If the trouble is in the pilot, you can remove it by disconnecting the unions at B. There's no need to take the main valve out of the line.

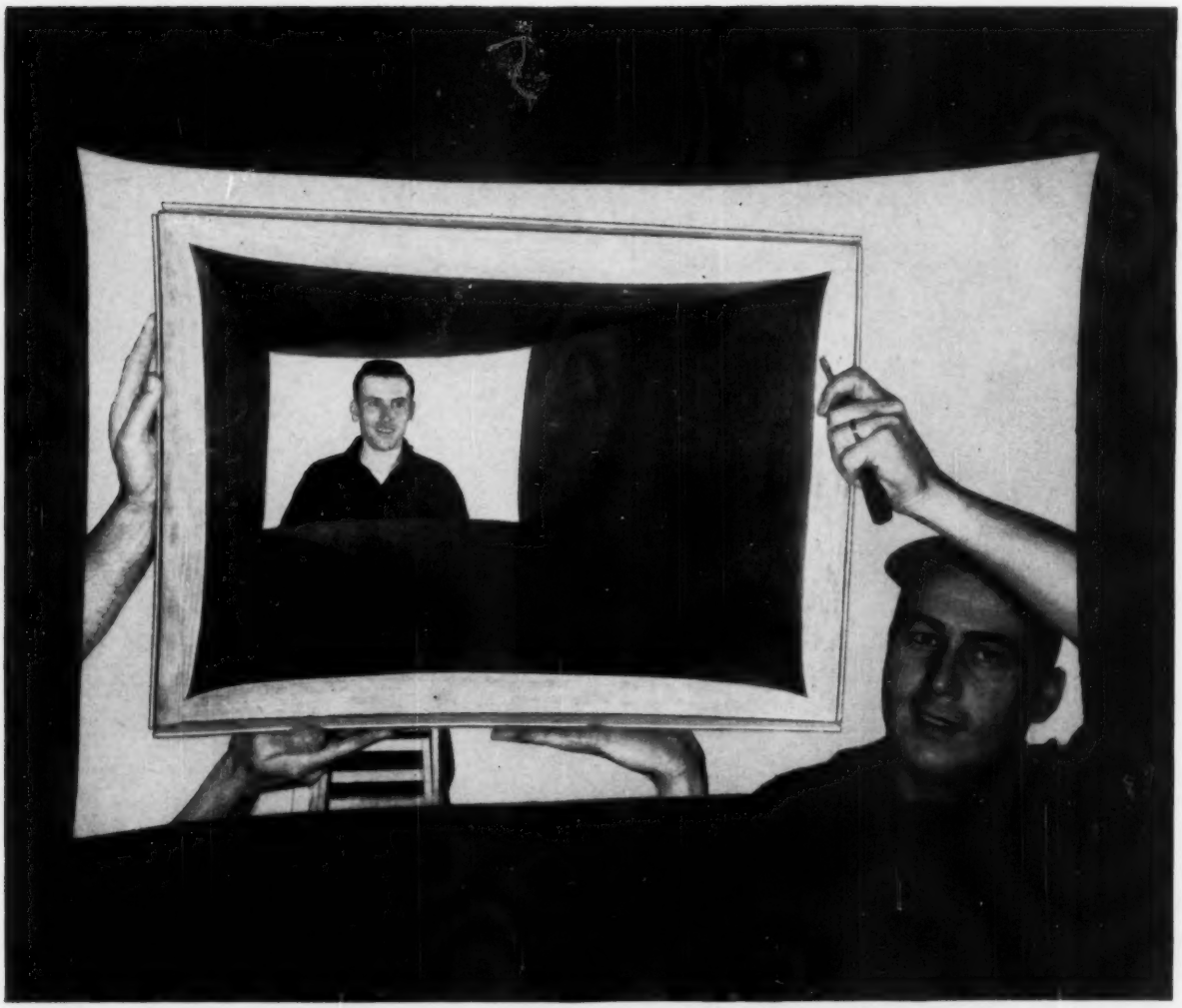
The quickest way to get the regulator functioning again is to install a spare pilot. This is easy — and in the Spence design it's not expensive to carry spare pilots. Spence pilots fit all sizes of Spence main valves. There's no need to stock an expensive inventory of pilots for each main valve size.

In the enlarged sectional drawing above, you can see how the strainer, seat and disc of the pilot are readily accessible by removing the blind flange.

If the trouble is in the main valve, here again inspection is easy. If there's dirt in the steam line, it may clog the bleed port or restriction orifices. In the Spence design these can be inspected and cleaned by merely removing the tubing connections. The seat and disc of the main valve can also be inspected easily by removing the top flange.

These maintenance advantages, plus other advanced design features, are available for a wide range of regulating applications. For information on Spence's wide range of different automatic regulating valves, write for your copy of Bulletin 1005.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York



Ducts lined with L·O·F Glass Fibers' Microtex are easy to fabricate and install; offer maximum insulation per dollar.

L·O·F Glass Fibers' Microtex duct liner gives 3-way protection, even at peak air velocities

For more efficient, 3-way insulation . . . under *all* operating conditions . . . at low cost, specify L·O·F Glass Fibers' Microtex duct liner. Fine glass fibers absorb mechanical noises; insulate warm- and cold-air ducts against heat transfer. Duct itself acts as a vapor barrier. Sprayed facing resists air erosion, even at top operating velocities.

Economical Microtex provides maximum insulation per dollar. Applied quickly with adhesive and formed with the duct in the brake, Microtex requires no special skills, tools or equipment. Can be easily cut and fitted into irregular sections. Available in 1½, 2, and 3 lb./cu. ft. densities, coated with black vinyl, Microtex is:

- strong
- fire-resistant
- permanent
- resilient
- lightweight
- pleasant to handle

Get the facts on high-efficiency, low-cost Microtex duct liner. Contact our distributor, or write: *L·O·F Glass Fibers Company, Dept. 39-28, 1810 Madison Avenue, Toledo 1, Ohio.*

L·O·F GLASS FIBERS

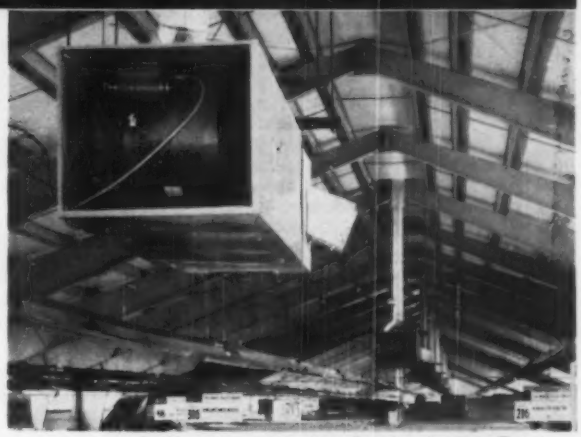
L·O·F GLASS FIBERS COMPANY • TOLEDO 1, OHIO

HOW WORLD'S LARGEST INDOOR MARKET KEEPS ITS CUSTOMERS COMFORTABLE

23 Jackson & Church Suspended Furnaces automatically distribute warm air

Near Middletown in southern Pennsylvania, the world's largest indoor shopping center under one roof sells everything from hamburgers to hearing aids . . . and from diamond rings to refrigerators.

The problem of correct, even heating for this 100,000 sq. ft. area was a complex one . . . until the Jackson & Church Division of York-Shipley came up with the ideal solution.



Looking along one section of market showing efficient Jackson & Church furnaces suspended out of the way.

Jackson & Church engineers installed a "zoned-heating" system which includes 23 J & C Suspended furnaces, varying in size from 152,000 to 280,000 Btuh. output per unit. Thermostatically controlled and equipped with heavy duty blowers and automatic burners, each furnace is responsible for the comfort of its own zone. Since the furnaces are suspended 16 ft. above floor level, no floor space was required for heating equipment.

Let famous Jackson and Church furnaces solve your commercial or industrial heating problems. As a first step, write for our equipment line folder or call your nearest Jackson & Church Distributor today.

J-C

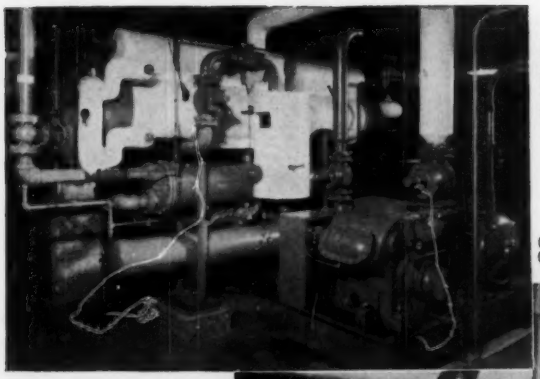
JACKSON & CHURCH

division of YORK-SHIPLEY, INC., YORK, PENNSYLVANIA

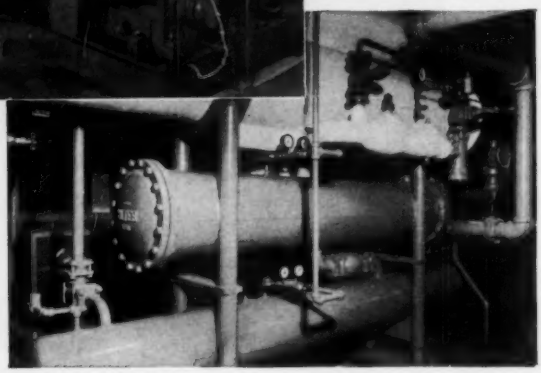
Oil & Gas-Fired Suspended Furnaces to 1,000,000 Btuh.

Basement Models to 4,750,000 Btuh. for all fuels.

Oil and/or Gas-Fired Direct-Fired Furnaces to 2,000,000 Btuh.



This Vilter air conditioning plant consists of a Freon shell and tube water chiller, shell and tube condenser, liquid receiver and a six-cylinder Freon VMC compressor, all installed in the Southwestern Bell Telephone Co., Olathe, Kansas.



Close up view of Vilter Condenser. Chiller is above. Receiver is below.

Custom-made CLIMATE

for busy office and toll switchboard

Vilter has brought the latest in "custom climate" air conditioning to the general offices and toll switchboard of the Southwestern Bell Telephone Company, Olathe, Kansas. Happier employees and more efficient operation is the satisfying result. Vilter equipment includes a: 6-cylinder Freon VMC compressor, 16″ x 10′ water cooler, 16″ x 7′ shell and tube condenser, 12″ x 10′ receiver.

All components in a Vilter air conditioning system incorporate the latest in engineering skill and industry practice. VMC compressors offer maximum capacity in a minimum of space. Built-in capacity reduction permits automatic operation at reduced loads with consequent power savings. Vilter's wide range of shell and tube equipment is right in performance and right in price.

Vilter also offers a completely "packaged" water cooler—the Vilter Uni-Chiller. Shop assembled for lower first cost, the Uni-Chiller offers space-saving design, simple installation and requires a minimum of maintenance.

You, too, can have all the advantages of modern air conditioning and refrigeration—specify Vilter.

Equipment furnished by O'Dower Engineering Company, Vilter Distributor in Kansas City, Missouri. Mechanical Contractor, U. S. Engineering Company, Kansas City, Missouri.

Write for these helpful bulletins to The Vilter Manufacturing Company
Dept. F-715, 2217 S. First Street, Milwaukee 7, Wisconsin

Bulletin 707
Vilter Condensers
Brine Coolers
Heat Exchangers

Bulletin 631
Vilter
Uni-Chillers

Bulletin 429
Vilter VMC
Freon
Compressors

Vilter®
REFRIGERATION and AIR CONDITIONING

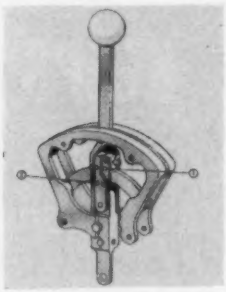
THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

EQUIPMENT DEVELOPMENTS

Continued from page 158

ture of testing without giving high surface temperatures, company says. Available as complete unit or as components including enclosed "Alundum" guarded hot plate assembly console and also a power, control, and measuring console. Console consists of plate having 4 in. test area with 3 in. guard, two cold surface heaters, two cold water plates all enclosed in cabinet.



Valve and Vent Lock . . .

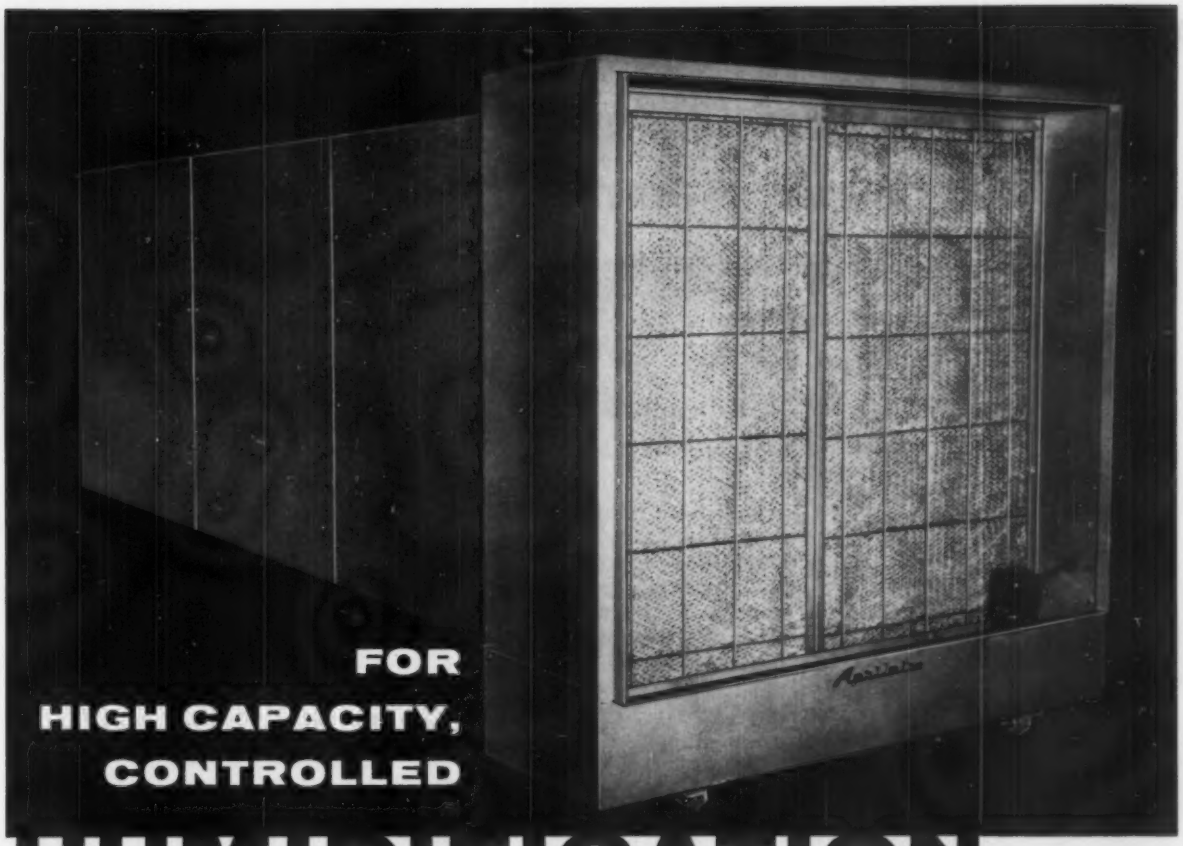
. . . designed to hold control settings, eliminate backlash and creepage of friction lock controls — *Reid Metal Products, Inc., Dept. HPAC,* 2021 *N. Lincoln St., Burbank, Calif.*

Automatic unit — said to be vibrationproof — now available in variety of sizes, models for applications in industrial, control fields. Applications include food processing machinery, automation equipment, chemical and petrochemical processes. Locking mechanism may be stacked for multicontrol units on ½ in. centers. Unit responds quickly, smoothly, freely to touch, company says.

Temperature Control . . .

. . . for installation where explosive vapors, gases are present — *United Electric Controls Co., Dept. HPAC,* 79 *School St., Watertown, Mass.*

Temperature settings of type "C-95" made by removing cover and setting hexhead adjustment screw. All switches are single pole, suitable for 180 F ambient temperature; rated for 15 amp at 115/230 volts a-c. Thermal system consists of bellows contained in bellows housing.



FOR
HIGH CAPACITY,
CONTROLLED

HUMIDIFICATION

RP Aprilaire

AUTOMATIC-ELECTRIC HUMIDIFIERS

HIGH CAPACITY

Aprilaire Industrial Humidifiers (illustrated) are designed to provide capacity for practically any size requirements. Unit sizes up to 10 G.P.H. — can be installed singly or in a series of any number of units.

POSITIVE CONTROL

The Aprilaire introduces relative humidity as needed . . . and only when needed. Automatic control eliminates possibility of lag or over-run.

FLEXIBILITY

Aprilaire industrial models are easily installed packaged units. Available for gas, steam or hot water heat source, every model can be pedestal-mounted or suspended — according to individual requirements.

BACTERIA REMOVAL

Super-clean air, carrying moisture in vapor form only, is delivered by the Aprilaire's unique principle, incorporating the use of air filters and mineral coated evaporating elements. This exclusive humidification method removes up to 70% of the bacteria in the air stream circulating through the unit.

ISOTHERMAL OPERATION

The Industrial Aprilaire has no temperature effect on the humidified air. Exhausted, humidified air is discharged at the same temperature it enters the unit.

MINIMUM MAINTENANCE

Because the only liming or water solids deposits occur on the inexpensive, replaceable evaporating elements . . . mechanical difficulties from these usually troublesome deposits are eliminated.

INDUSTRIAL AND RESIDENTIAL MODELS AVAILABLE–WRITE FOR COMPLETE INFORMATION

see our catalog in PLANT ENGINEERING FILE or write for copy

RP . . . PRODUCTS OF RESEARCH

RESEARCH PRODUCTS Corporation

Dept. 912, Madison 10, Wisconsin

Announcing
our new name

ELLICOTT

FABRICATORS, INC.

formerly NOVELTY STEAM BOILER WORKS, INC.

Out of fifty years of experience comes a new name in metal fabrication. Ellicott specializes in fabricating unfired pressure vessels, hot water generators, storage vessels, heat transfer equipment, special metal fabrication. Ellicott offers a complete line of metal and non-metal linings, including the latest plastic linings that resist corrosion even under high temperatures.

Specify ELLICOTT
THERE'S NO EQUAL

ELLICOTT
FABRICATORS, INC.
SUBSIDIARY OF
ELLICOTT MACHINE CORPORATION

HOT WATER GENERATORS | STORAGE TANKS | SPECIAL LININGS | SPECIAL FABRICATION

Representatives in Major Cities

Clare and Kloman Streets • Baltimore 30, Maryland

EQUIPMENT DEVELOPMENTS
Continued

Bellows — filled with temperature sensitive liquid — expands or contracts with heating or cooling, activating snap action switch at desired preset temperature point, company says. Three models available with adjustable ranges between zero, 425 F.

Solenoid Valve . . .

. . . featuring plunger seal design with soft rubber seal — *Valcor Engineering Corp., Dept. HPAC, Carnegie Ave., Kenilworth, N. J.*

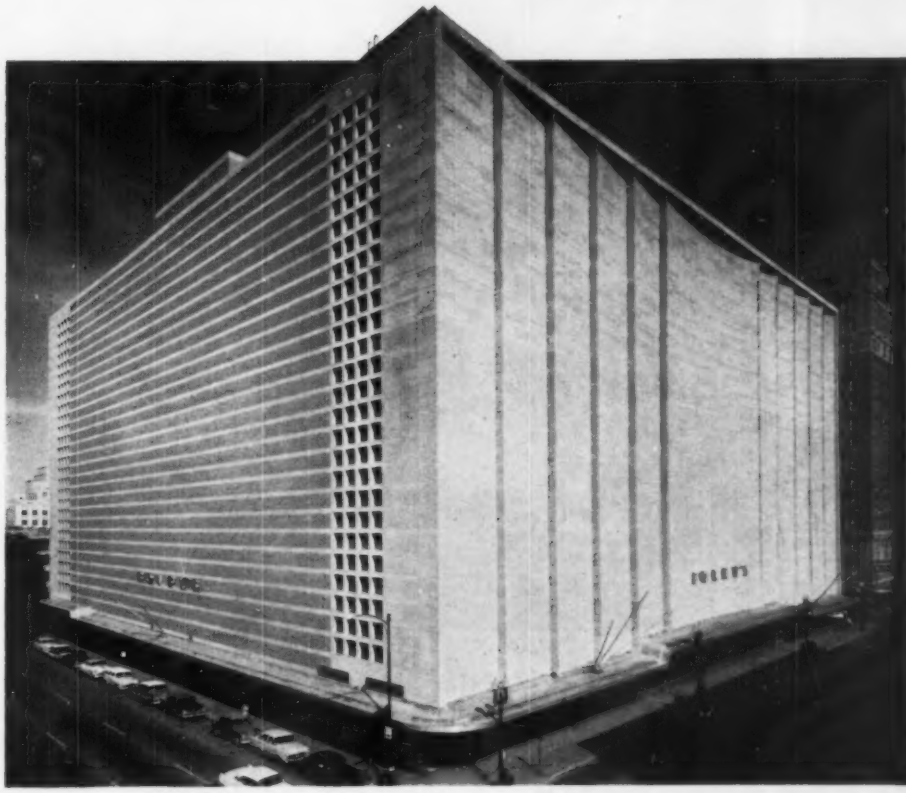
"SV-4900" series dependable for millions of cycles with full operation in any position, company says. They have stainless steel internal construction with brass body. Available 7/64 orifice rating 130 psi maximum, 5/32 rated 60 psi maximum; 2 7/20 in. high, 1½ in. wide. Units designed for general usage with water, air, steam, inert gases, petroleum, vegetable oils, gasoline, kerosene.

Temperature Transmitter

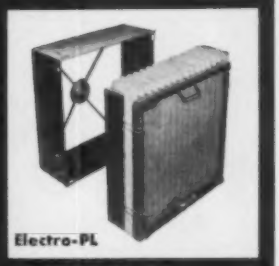
. . . for pneumatic transmission of temperature measurement in ranges 100 to 600 F, with spans of 100, 200 F — *Foxboro Co., Dept. HPAC, Foxboro, Mass.*

Use of expanded scale increases output pressure change per degree temperature change, providing increased receiver control action, excellent readability at both transmitter and receiver, company says. Vapor pressure thermal system includes 4 × ⅜ in. bulb, 18 in. bendable bulb extension, adjustable union connection, polyvinyl plastic covered

NOTHING BUT THE BEST AIR FOR TEXAS' BIGGEST STORE!



Roll-O-Matic



Electro-PL

FOLEY'S, HOUSTON, TEXAS. Architect: Kenneth Franzheim, Houston; Engineers: Lee S. Weil and Walter B. Moses, New Orleans; Contractor: Strauss-Frank Co., Houston.

AAF's Roll-O-Matic and Electro-PL filters keep air sparkling clean at Foley's

Clean ventilation air was part of the planning of Foley's in Houston, Texas' biggest department store. Nothing but the best would do, and it was achieved by the selection and installation of two top-flight filters from the complete AAF line—Roll-O-Matic and Electro-PL.

The amazing Roll-O-Matic cleans itself automatically while it cleans the air. Maintenance amounts to nothing more than a once-a-year replacement of Roll-O-Mat media—a job that's as simple as loading film in a camera. The Electro-PL—also a renewable-media filter—is the *only* filter that combines mechanical filtration with electronic action. Maintenance? Infrequent replacement of inexpensive media.

For more information, call your local AAF representative or write direct for Roll-O-Matic Bulletin No. 248A and Electro-PL Bulletin 257.

AAF American Air Filter
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

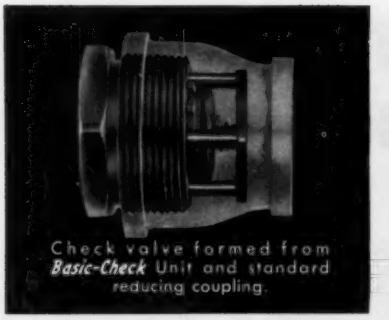
AAF Dust Control Equipment

Illinois Heating Specialties

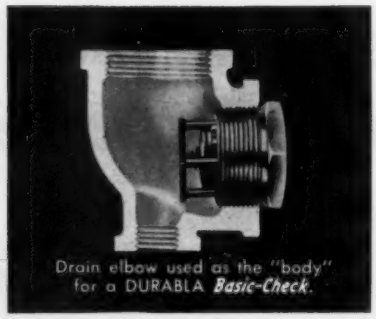
BETTER AIR IS OUR BUSINESS

Herman Nelson Unit Heaters

Herman Nelson Unit Ventilators



Check valve formed from *Basic-Check* Unit and standard reducing coupling.



Drain elbow used as the "body" for a DURABLA *Basic-Check*.

Basic-Check used with a standard side inlet.

Basic-Check at inlet end of this bend completes the check valve.

How you can "make" a check valve to meet any emergency

Just take a DURABLA *Basic-Check* Unit . . . combine it with any standard pipe fitting . . . and you have a complete check valve that's perfect for practically any service. Keep a few *Basic-Check* Units on hand and you are prepared for any emergency.

Because it will operate in any position, the DURABLA *Basic-Check* can be installed without changing existing lines. Made of stainless steel, they'll handle almost any liquid, gas or air . . . over a broad range of pressure-temperature ratings.

DURABLA *Basic-Check* Units are versatile, dependable, efficient and inexpensive. They come in seven standard line sizes, from ⅜" to 2". Also available: DURABLA Reducing Couplings of stainless steel.

Ask for a copy of Bulletin HPAC 28.

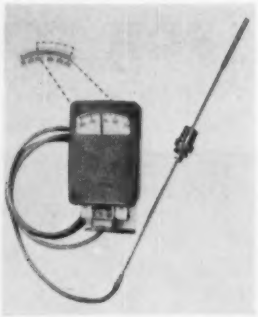
DURABLA MANUFACTURING COMPANY
114 Liberty Street, New York 6, New York

DURABLA®

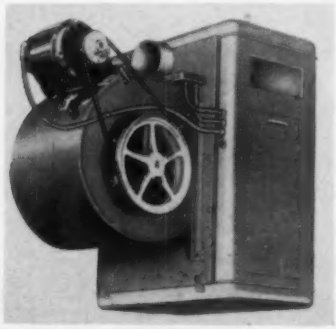
DM-32

EQUIPMENT DEVELOPMENTS

Continued



bronze tubing over copper capillary. Liquid, gas filled systems available for temperatures above 600, below 100 F. Transmitter is 10 ⅛ in. high, 5 ⅞ in. wide, 4 ⅛ in. deep; weighs 10 lb.



Gas Unit Heater . . .

. . . with controls, connections concealed within heater casing — *Reznor Mfg. Co., Dept. HPAC, 51 Union St., Mercer, Pa.*

Control assembly located on one side of heater easily accessible through large snap-out panel, company says. All units in standard series now equipped for use in duct systems with static pressures to 0.2 in. Available in 10 sizes, 25,000 to 300,000 Btu.

Thermostat . . .

. . . with range 35 to 90 F — *Mears Electric Controls, Inc., Dept. HPAC, Swan Island, Portland 11, Ore.*

New unit is only 2 11/16 in. long, 1 ⅝ in. wide, 1 1/16 in. thick. May be mounted in heaters of baseboard, wall, portable types; also, electric steam radiators, other electric heating equipment. Bimetal thermal element accurate to within 1 deg, is not affected by changes in air pres-

TEVA* revealed that SNAP*ON pipe insulation would save $10,140!

- an initial saving of $10,140 on 15,000 ft. of pipe insulating material!
- an annual operating saving of $1836!

. . . these were some of the reasons why one-piece Snap*On glass fiber pipe insulation was recently selected for the process lines of a huge new industrial plant. Method used to compare various insulations was TEVA (Thermo-Economic Value Analysis).* TEVA findings showed that 1½" Snap*On was *thermally more efficient* than 2" of the compared insulation, and thus $10,140 could be saved on material alone. Application savings, based on actual time studies, were estimated at 15%-20%. Operating savings of 3.6 billion Btu/year were calculated to result in an additional annual saving of $1836.

***TEVA (THERMO-ECONOMIC VALUE ANALYSIS) IS AN EXCLUSIVE G-B SERVICE, YOURS FOR THE ASKING. FOR TEVA SERVICE, CALL YOUR LOCAL G-B DISTRIBUTOR.**
(Listed in the Yellow Pages in 66 Cities)

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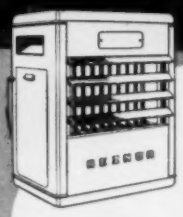
Manufacturing Company GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe coupligns and fittings
Molded glass fiber pipe insulation

220 W. 10th St., Kansas City, Mo.

modern heating for business and industry...

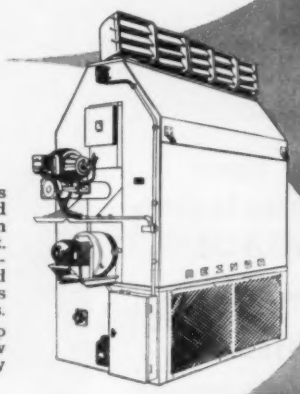
REZNOR
UNIT HEATERS



SUSPENDED TYPE

Gas-fired—for use with natural, manufactured, mixed or LP gases. Eleven sizes: 25,000 to 300,000 Btu input. All sizes available with choice of propeller fan or centrifugal blower for air movement. FlexiTemp control system, featuring automatic two-speed fan operation, optional on propeller fan models up to 100,000 Btu. Aluminized steel construction standard, stainless steel optional at extra cost. These heaters are self-contained, completely automatic units for the production and distribution of heat at the point of need. Installation involves only suspension, utility connections and venting. Practically no maintenance required.

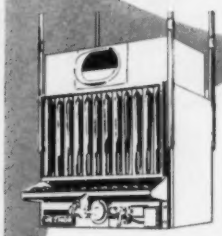
Floor-mounted models for use in offices and similar areas available in 25, 50, 65, and 75 thousand Btu sizes.



FREE-STANDING TYPE

These stainless steel direct-fired heaters are designed for large industrial and commercial space heating jobs. Ten sizes, 400,000 to 2,000,000 Btu input. Heaters can be equipped with gas burners (for natural, mixed, manufactured or LP gases), oil burners (for fuel oils through #5 grade) or dual-fuel burners.

Heaters may be floor-mounted for top discharge or suspended for down-flow or horizontal discharge. They are easily adapted for use in duct systems.



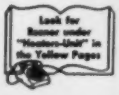
DUCT TYPE

Reznor duct heaters are compact, highly efficient gas-fired heat exchangers with a full complement of operating controls. They are designed for assembly in custom engineered duct systems with components for air moving, cooling and filtering specified to meet exact job requirements.

Series DS sectional duct furnaces (shown) are available in 4 sizes . . . 150, 200, 250, and 300 thousand Btu. Systems with capacities in excess of 2,500,000 Btu can easily be assembled using these four basic units. Aluminized or stainless steel construction. Accessory blowers available to meet most air delivery requirements.

there is no "equivalent" for Reznor unit heaters

for complete details, wherever you are . . .



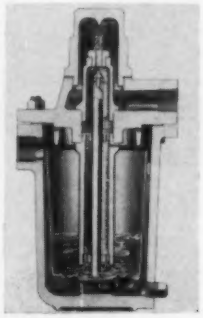
REZNOR
WORLD'S LARGEST-SELLING DIRECT-FIRED
UNIT HEATERS

Reznor Manufacturing Company
51 Union Street, Mercer, Pa.

EQUIPMENT DEVELOPMENTS

Continued

sure or weather extremes, manufacturer says. Ratings on 20 amp model are 2500 watts at 125 volts a-c; 5000 watts at 250 volts a-c. Ratings on 22 amp model are 2750 watts at 125 volts a-c; 5500 watts at 250 volts a-c.



Steam Traps . . .

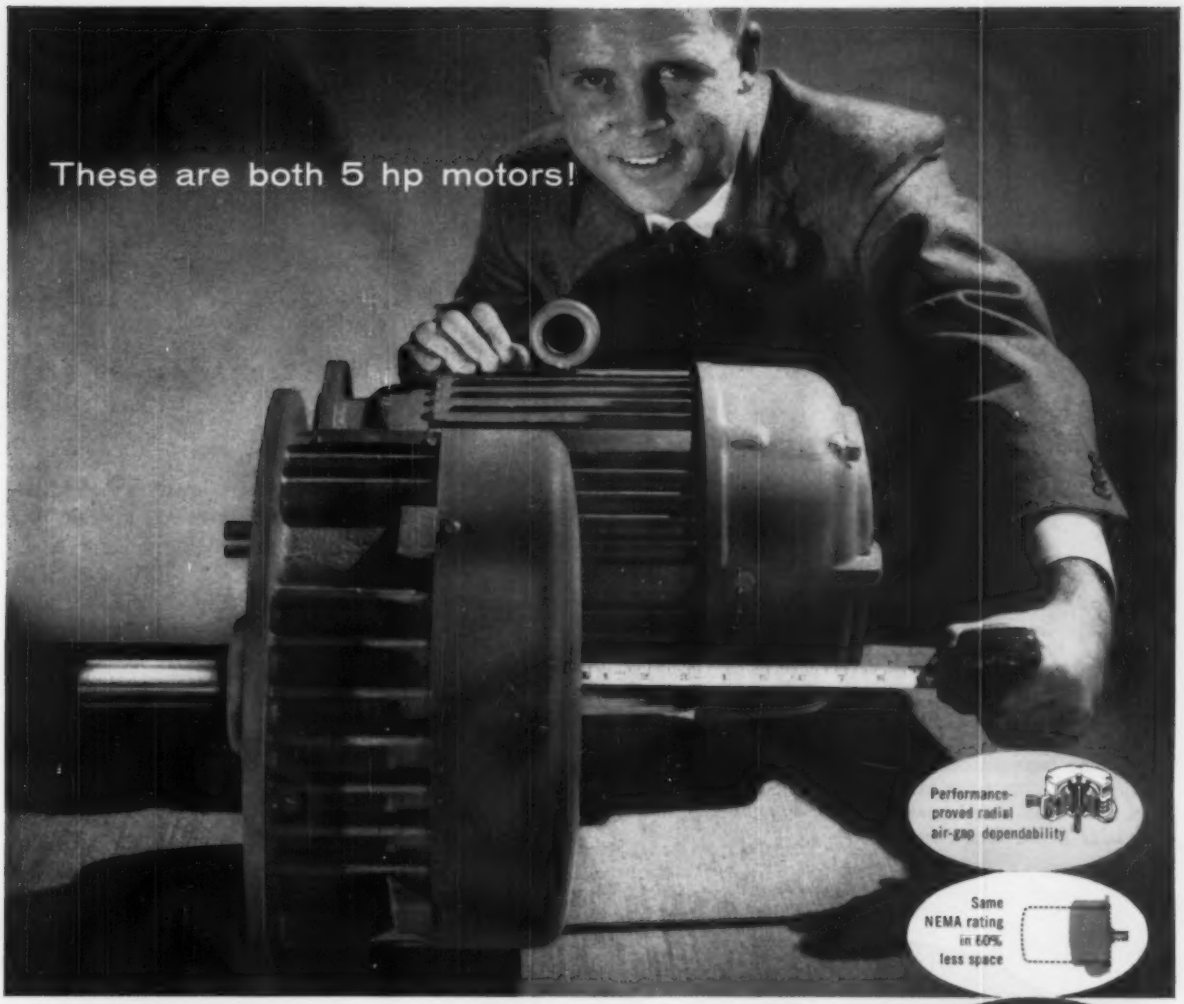
. . . with impeller driven rotating valve — *H. O. Trerice Co., Dept. HPAC,* 1420 *W. Lafayette Blvd., Detroit* 16.

Valve assembly comprises bucket, valve impeller operating as integral unit. Impeller changes seating position of valve at every discharge; prevents uneven wear of valve and orifice, wire drawing, steam leakage, manufacturer says. Removable cap permits inspection of valve, seat without disturbing high pressure bolts or gasket.

Roof Ventilators . . .

. . . designed for exhausting air from buildings — *Trane Co., Dept. HPAC, La Crosse, Wis.*

Ten direct drive, 11 belt sizes available. Spun aluminum units with 7, 9, 10, 12, 13 in. diameter backwardly inclined centrifugal fan wheels are direct drive. Air volume ranges 180 cfm to 2330 cfm. Sizes



60% shorter– but with radial air-gap design!

New Louis Allis Pancake Motor preserves all the advantages of conventional motor construction

The new Louis Allis Pancake Motor is your solution to trouble-free power in any space-cramped motor application.

The Pancake is a remarkably short flange-mounted motor — up to 60% shorter and 33% lighter than standard motors of the same rating! And it is built in *conventional* radial air-gap design!

It's done by an ingenious forming process which literally compresses the end coils of a conventional radial air-gap motor into an exceptionally short length. The result is a compact, light motor ideally suited for horizontal or vertical mounting on machine tools, roof ventilating fans, or *any* close-quarter installation where space is a critical design factor.

What's more, this is achieved without sacrificing a single desirable characteristic: the stator still contains the same iron and copper as standard Louis Allis motors . . . standard NEMA service factor is maintained . . . high insulative values are retained by using proved Louis Allis varnishes and new insulating techniques . . . over-sized pre-lubricated bearings are used to guarantee long bearing life . . . and the entire motor is enclosed in an industrial-type cast-iron housing designed to shrug off abuse!

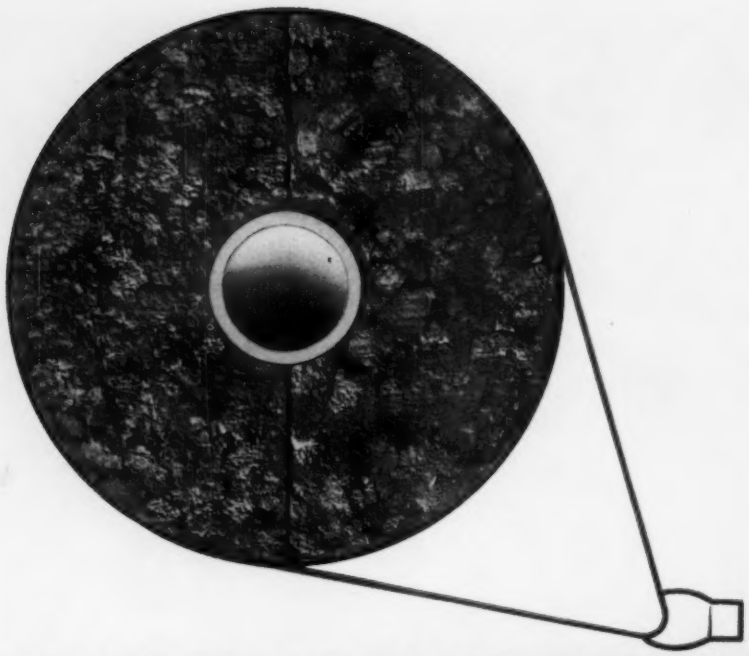
The housing and flange are cast in one piece: this permits extra-accurate internal machining which extends bearing life and reduces noise levels to a new low.

Investigate the Pancake Motor through your local Louis Allis District Office. Sized from 1 to 15 hp, at 1800, 1200, and 900 rpm, in open drip-proof and enclosed non-ventilated or fan-cooled enclosures. Write for Bulletins 2100 and 2150 to the Louis Allis Co., 453 E. Stewart St., Milwaukee 1, Wis.

8M-101

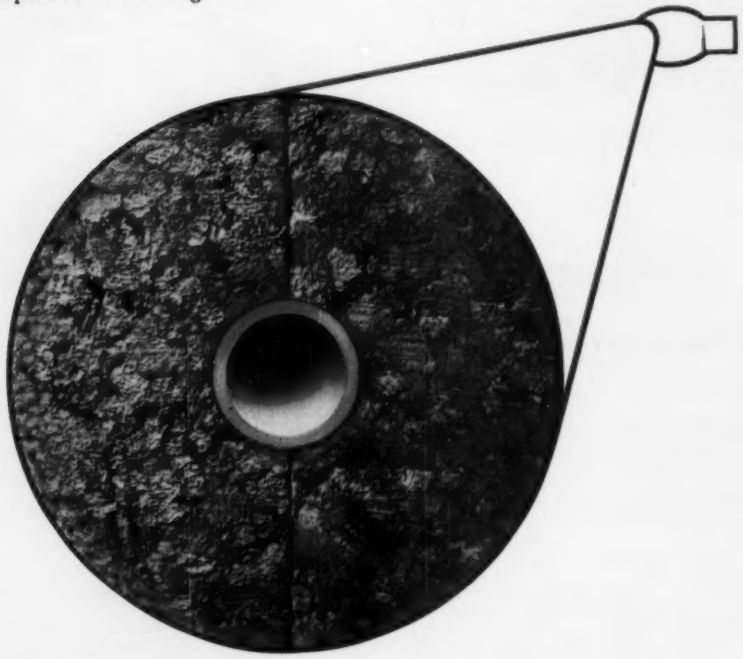
LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES



UNITED'S MOLDED CORK PIPE COVERING

Made from pure, clean, granulated cork compressed and molded to exact size. Extremely stable K factor over wide, low temperature range. Will not rot or support combustion. Clean, sanitary and odor free. Fits tighter . . . goes on faster . . . provides maximum protection. Available in a wide variety of sizes from local stock, coast to coast. *Try it — it's unsurpassed . . . and least expensive in the long run!*



UNITED BB CORKBOARD

UNITED CORK COMPANIES

Since 1907

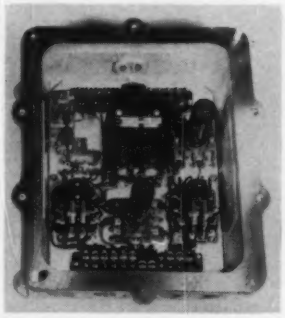
1 Central Avenue, Kearny, New Jersey

Engineering offices or approved distributors in key cities — coast to coast.

EQUIPMENT DEVELOPMENTS

Continued

in 15, 16, 18, 20, 22 in. categories can be either direct or belt drive. Range of these is 900 to 6596 cfm. Larger belt driven ventilators available with 24, 27, 30, 33, 36, 40 in. diameter centrifugal backwardly inclined fan wheels. Air volume ranges 2170 to 23,427 cfm.



Explosionproof System . . .

. . . designed for rotating, reciprocating equipment in hazardous locations — *Robertshaw-Fulton Controls Co., Instrument Div., Dept. HPAC, 2920 N. Fourth St., Philadelphia 33.*

Malfunction detector, control units mounted in explosionproof casings. Control unit used to provide time delay when protected equipment is started, thereby preventing alarm or shutdown from single shocks or transient disturbances, company says. Available for a-c, d-c circuits.

Globe Type Needle Valve

. . .for use as gage and for metering service in gas, oil, water lines — *Kerotest Mfg. Co., Dept. HPAC, 25-25 Liberty Ave., Pittsburgh.*

Unit developed to provide high quality, economical valve for applications where space is factor, where

When SofTite Galvanized Steel Sheets were introduced, we said – *anything* that can be made of steel sheets can be made of Wheeling SofTite Galvanized Sheets. This challenge still stands today! For SofTite Sheets are easy to work . . . and have a tight galvanized coating that will not flake or peel.

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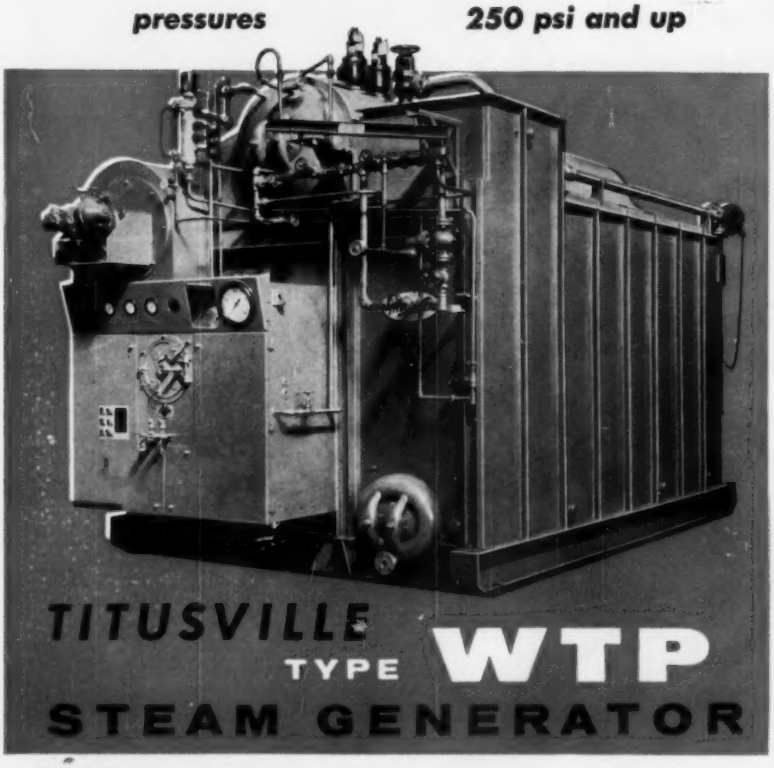
WHEELING STEEL CORPORATION, WHEELING, WEST VIRGINIA *District Sales Offices at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco, Wheeling*

PERFORMANCE

Meeting Your Most Rigid Requirements—in Capacities to 60,000 lbs.

pressures *250 psi and up*



Tops in steam generating performance is matched by outstanding dependability in Titusville's Type WTP Water Tube Steam Generators. Completely factory-assembled, ready to ship by flatcar or truck trailer, Type WTP is easy to install in your boiler-room. • Let us show you why and where Type WTP is serving many of the toughest boiler assignments in the country. When writing, ask for Bulletin 5511.

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BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units

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Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

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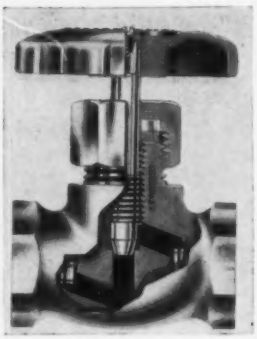
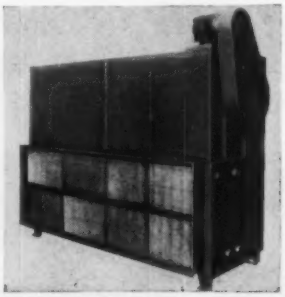
EQUIPMENT DEVELOPMENTS

Continued



operating areas are close, manufacturer says. Unit features one piece solid forged carbon steel body with 12/14 chromium heat treated stainless steel stem with teflon packing. Available in sizes ⅛, ¼, ⅜, ½ in. New product has working pressure of 10,000 psi at 70 F, maximum operating temperature of 500 F.



Air Conditioner . . .

. . . with 75 to 100 ton capacity — *Thermal Engineering Corp., Dept. HPAC, 2605 W. Dallas, Houston* 19.

Equipment includes design features of sectional construction for greater ruggedness, welded for rigidity, slide rails for easy removal of coils for cleaning, company says. Cabinet, access panels, drain pan fabricated of heavy gage black, cold rolled furniture steel, bonderized, then finished with coat of zinc chromate and coat of grey enamel primer.

Temperature Scanner . . .

. . . designed to provide over and under temperature protection—*Tipptronic, Inc., Dept. HPAC, Chagrin Falls, Ohio.*

Function of unit is to serve as one temperature alarm instrument capable of sensing several control

MOTORPUMPS

for air conditioning systems that demand pumping dependability

Sizes from ¼ to 75 horsepower

Every time you specify Ingersoll-Rand Motorpumps as an integral part of an air conditioning system, you're not only adding a strong sales point, you're also saving yourself time and trouble in costly call-backs.

Air conditioning contractors know that Ingersoll-Rand Motorpumps—designed specifically for air conditioning—have the rugged construction and modern features that mean continuous trouble-free service. In addition, you get easier, faster installation because compact Motorpumps require less space and will operate efficiently in any position.

Get the complete story by writing today for the latest literature on Ingersoll-Rand Motorpumps for Air Conditioning.

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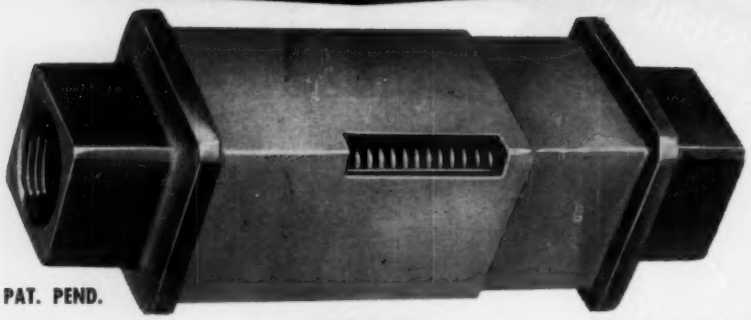
Keflex QUADRA-SIDE

Telescopic Expansion Compensators

WITH LAMINATED STAINLESS STEEL BELLOWS, 2 PLY OR MORE

. . . *something new for the* ARCHITECT — ENGINEER — CONTRACTOR

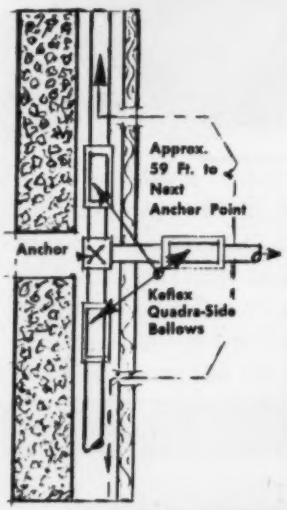


PAT. PEND.

TYPE 7Q SIZES ¾"-3" Inc.

Working Pressure 300 P.S.I. — Temperature to 800°F. — Has Reserve Strength — Not Just Borderline Prospect of Withstanding Effect of Pressure — Shock — Thermal Line Expansion — High Temperature — Moderate Vibration.
HIDDEN PROTECTION PLUS! All Non Corrosive Stainless Steel Bellows With Brass or Bronze End Fittings and Telescopic Shrouds.

KEFLEX FITS IN NARROWEST WALL SPACE—SAFE—PERMANENT



● **ROUND** KEFLEX Bellows are made of Laminated Stainless Steel, multiple ply (usually 2 ply or more) for greater strength with minimum force required to move bellows. The minimum force to move 7 Q Keflex Bellows greatly reduces the need for additional anchoring above that required to handle line pressure thrust force as the force to move Keflex 7 Q only is always less than 100 lbs.

● **FLAT** KEFLEX FLAT GUIDES offer so many advantages it is difficult to mention them all. Briefly: The KEFLEX FLAT OUTSIDE GUIDE (shroud) is made of brass USUALLY formed square of required length —one unit end will telescope over other unit end. The flat surfaces slide over and in one another—practically eliminating possibility of torque as result of faulty installation. This ASSISTS PROPER GUIDING.

● **SQUARE** KEFLEX SQUARE END FITTINGS are made of heavy, non-porous, square, bronze stock, and threaded tapered female pipe size. They are attached to the KEFLEX 7 Q bellows and the outside guides by silver brazing. The result is an easy moving expansion joint that will absorb either the slightest or the greatest thermal pipe expansion and with practically no load on the anchors. The heavy bronze ends, which will not crush during normal installations, assures safe and leakproof joints.

KEFLEX ®

▶▶▶ WRITE TODAY FOR LITERATURE

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SINCE 1905

KEFLEX MANUFACTURING DIVISION

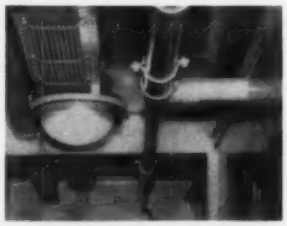
454 EAST THIRD STREET, LOS ANGELES 13, CALIFORNIA

SAN FRANCISCO 5 63 MAIN ST. | PORTLAND 9, OREGON 328 N.W. BROADWAY | SEATTLE 4, WASHINGTON 2425—6TH AVE. S.

EQUIPMENT DEVELOPMENTS

Continued

points providing alarm if one of these temperatures exceeds or fails to reach preset limit, company says. Thermocouples connected to stepping switch which samples output of each thermocouple. Signal then delivered to terminals of contact meter. Alarm mechanism may be located close to points to be monitored or at remote central location.



Air Conditioning System . .

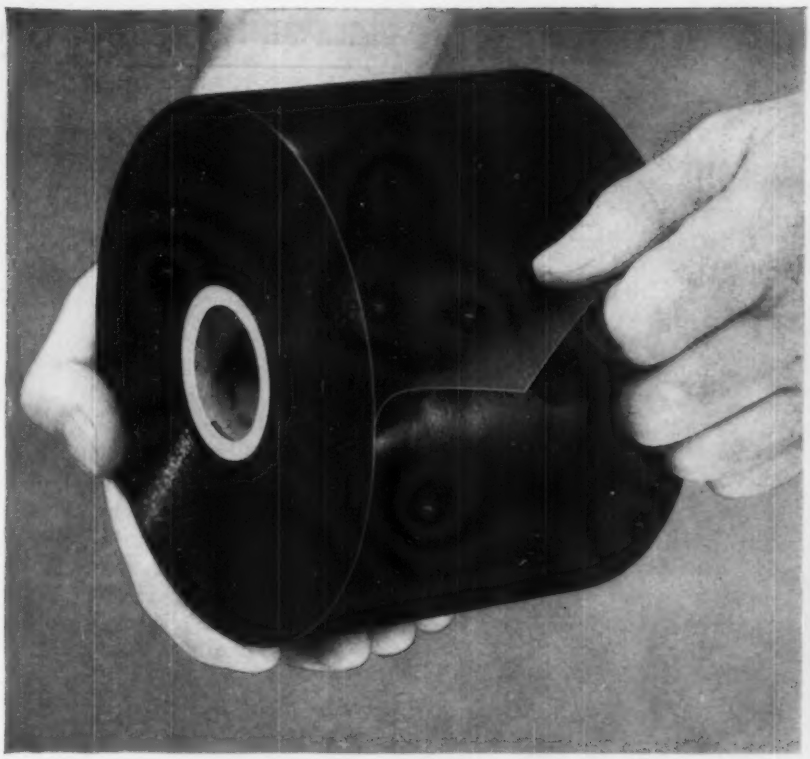
. . . utilizing small 1¾ to 4¼ in. OD pipes — *Hi-Press, Air Conditioning of America, Inc., Chrysler Bldg., Dept. HPAC,* 405 *Lexington Ave., New York* 17.

System designed to transmit treated air at velocities of more than 6000 fpm. Features cited by manufacturer: compactness, simplicity of installation, ease of maintenance. Individual temperature, air volume controls provided.

"S" Section Sheave . . .

. . . designed to permit wider speed changes, increased horsepower transmitting capacity — *Allis-Chalmers Mfg. Co., Dept. HPAC,* 1171 *S. 70th St., Milwaukee* 1.

New single groove sheave has range of 5.5 in. minimum to 120 in. maximum. Companion sheaves in sizes 8 to 24 in. pitch diameter available along with "S" section belts in lengths 54 to 150 in. Each belt has minimum width of 2 1/16 in.



New low price! SCOTCHRAP
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BRAND
PIPE PROTECTION TAPE

...the superior pipe coating

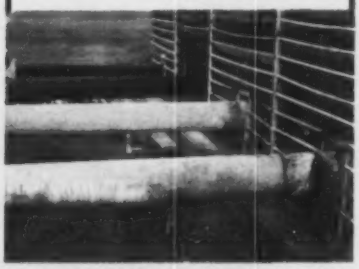
"SCOTCHRAP" Pipe Protection is polyvinylchloride plastic in handy tape form . . . a pipe coating tape designed especially for long term pipe protection. Compared to all other pipe coatings and coverings, "SCOTCHRAP" Brand Pipe Protection Tape is superior in these important qualities: *Toughness*—to resist abrasion from backfilling and underground soil stresses. *Lower conductance*—to resist electrolytic corrosion and insure longer pipe life. *Adhesion shear strength*—"SCOTCHRAP" sticks at a touch . . . and stays in place despite shear forces exerted by soil stresses. All this, plus new low prices, make "SCOTCHRAP" Pipe Protection Tape *your best buy*. Best for joints and fittings—best for total coatings of entire distribution systems!

Check into the new savings possible with "SCOTCHRAP" Brand Pipe Protection Tape. You'll be glad you did!

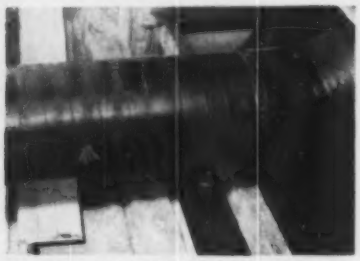
"SCOTCHRAP" is a registered trademark for pipe protection products made in U.S.A. by Minnesota Mining and Manufacturing Co., St. Paul 6, Minn.

"SCOTCHRAP" Pipe Protection Products

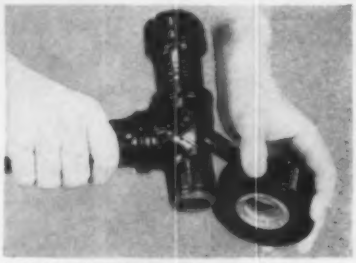
LOOK what you can do with "SCOTCHRAP"



STOP CORROSION completely! This photo shows far pipes covered with "SCOTCHRAP" . . . near pipes covered with other coating . . . leading into compressor station cooling tower. Pipes were subjected to acid and chlorine-bearing water for two years . . .



SEE HOW "SCOTCHRAP" Pipe Protection guarded this pipe. This close-up shows how pipe was so perfectly intact, you could still see imprint of "SCOTCHRAP" Adhesive on the prime coat.



MAKE QUICK WORK of insulating joints, tees, elbows in the field. Superconformable "SCOTCHRAP" goes on easily, quickly, without special tools or heat . . . gives positive system-wide protection.

SAVE TIME on long lines. With wide-width "SCOTCHRAP" and "Betzel" Tapester, one man covers 200 feet of 4" pipe in less than 30 minutes. For complete information, write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. PD-28.

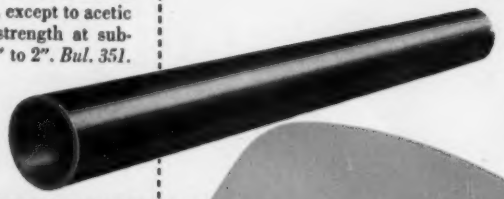
MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

STAYS TOUGH
AT SUB-ZERO TEMPERATURES

Ace Parian . . . odorless, tasteless, rigid polyethylene. Best chemical resistance of any plastic at room temp. except to acetic acid. Excellent impact strength at sub-zero temp. Rigid pipe ½" to 2". *Bul. 351.*



SUPPLEX . . .

Money-saving flexible pipe for water lines

Supplex is non-toxic flexible polyethylene pipe, ideal for water distribution lines, drain lines, jet wells, etc. Excellent chemical resistance. Need only screwdriver and knife to install, using Ace insert type fittings. Approved by National Sanitation Foundation for drinking water. Sizes ½" to 2". *Bulletin CE-57.*

Now eleven ACE Materials to STOP CORROSION

Eleven job-proved rubber and plastics materials now available in ACE piping, valves, pumps and tanks. Tough Ace-lite rubber-plastic blend . . . Saran . . . heat-resistant Tempron . . . Riviclor PVC . . . many others. Write for comparative properties Bulletin CE-50 . . . or call your American Hard Rubber Co. distributor.

FOR HIGH PRESSURES
OR BIG PIPE LINES

Ace Rubber-Lined Steel . . . strength and pressures of steel plus chemical resistance of hard rubber. Excellent for alkalis, most inorganic acids, many organic acids, all salts, bleaches. Sizes 1¼" to 24" and up. *Bulletin CE-52.*

RIGID VINYL . . . STRONG,
AGE-PROOF

Ace Riviclor is a new rigid threaded plastic pipe with good aging and high impact strength. Not affected by most inorganic acids and alkalis, also excellent for many organics. Sizes ½" to 4". *Ask for Bulletin CE-56.*

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
Ace Road • Butler, New Jersey
DIVISION OF AMERACE CORPORATION

EQUIPMENT DEVELOPMENTS
Continued

Portable Crane . . .

. . . that weighs less than 20 lb — *Mechanical Refrigeration Enterprises, Dept. HPAC, Box* 122, *North Hollywood, Calif.*

Unit lifts more than 125 lb to height of over 7 ft. Boom adjustable vertically to permit pinpoint loading, easy entrance between shelving aisles. Heavy duty rubber wheels permit easy moving, maneuvering, company says.

Filter Cloth Bags . . .

. . . with corrosion resistant polyethylene zippers—*Filtration Fabrics Div., Filtration Engineers, Dept. HPAC,* 155 *Oraton St., Newark, N. J.*

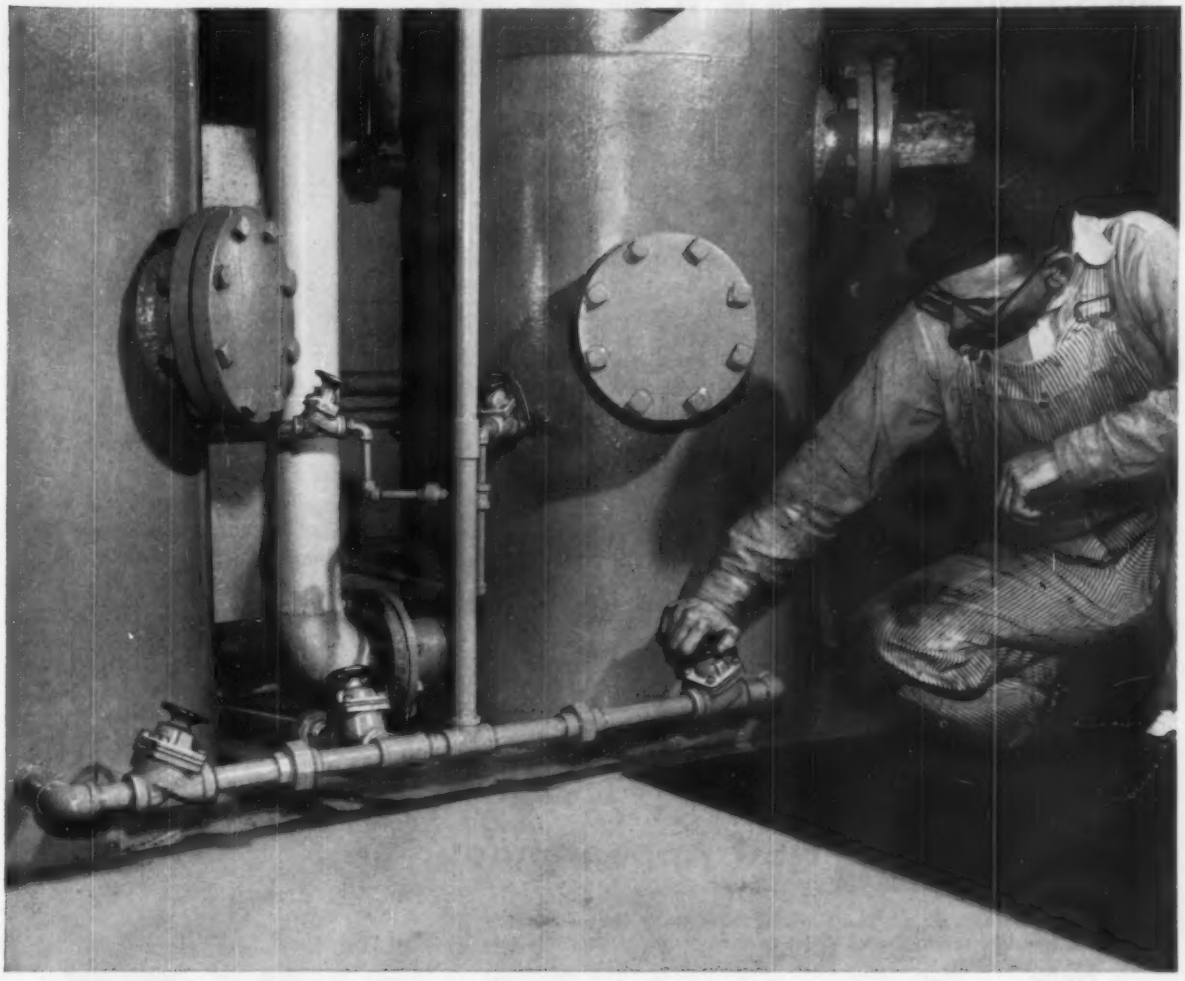
Zippers ride in smooth grooves with no teeth to snag or collect materials that can jam closure or flake off, contaminate product, company says. Zippers sewn to cloth with stitches designed to prevent leaking. Suggested applications are for air ducts, tank covers.

Gas Fired Duct Furnaces . .

. . . designed for easy installation — *Carrier Corp., Dept. HPAC,* 300 *S. Geddes St., Syracuse* 1, *N. Y.*

Compactness of units makes them adaptable for heating in conjunction

How Liquid Carbonic stopped potassium permanganate leakage



700% longer service with these Crane valves . . . still going

This case history could save money in your own operation.

Liquid Carbonic Corporation, Seattle, Wash., is using these Crane packless diaphragm valves to handle potassium permanganate in lines to scrubbers. Before installing Crane No. 1610 ½" and 1" valves, this dry ice plant had to replace valves of another make at least every 6 months. Constantly recurring leakage around stems called for frequent stuffing box maintenance and hindered operations.

Since changing to Crane packless diaphragm valves, there has been no leakage, no trouble of any kind in 3½ years. Valve service is already 700% better. Here's why: Crane packless diaphragm valves completely eliminate the need for stem packing and the problems of stuffing box leakage and maintenance. The diaphragm seals the bonnet from line fluids.

Make sure your valves have correct design, better materials, precision assembly, thorough testing . . . insist on Crane, from the world's largest, most complete line of valves and fittings for industry.

ASK your Crane Representative for Crane Folder AD-1942 on packless diaphragm valves, or write Crane Co., address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

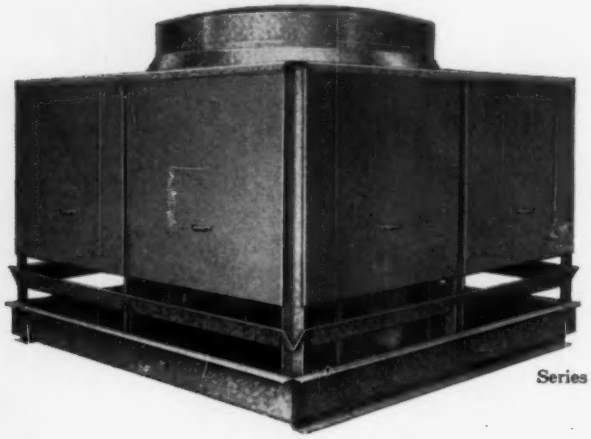
Since 1855 — Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

Introducing the **DOVER**

silLOWETTE

COOLING TOWER

(5 to 150 ton capacities)



Series R

The Boldest Advance in Cooling Tower Design in Years!

BOLD New Appearance!

LOW SILHOUETTE . . . The Dover silLOWette is designed to hug the roof line in any installation . . . the type of design architects are demanding.
COLOR . . . That's right . . . *color!* For the first time, real BEAUTY in a cooling tower with white transite or colored plastic side panels. Available in a wide range of colors.
LIGHTING . . . Translucent panels permit interior lighting of silLOWette tower for attractive display purposes.
GALVANIZED STEEL . . . All steel parts of the silLOWette tower are hot dip galvanized *after* fabrication to prevent rust and corrosion. Assures attractive appearance plus years of service.

Bold NEW Features!

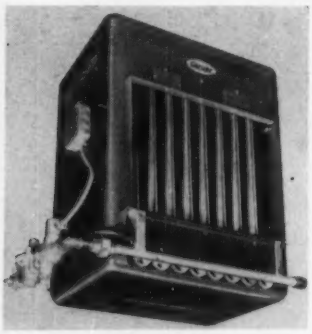
REMOVABLE SIDE PANELS . . . Just flip side panels up-and-out, and tower interior is completely accessible! No bolts, no screws!
AIR COOLED BEARINGS . . . Unique bearing arrangement gives longer life from bearings with less maintenance. External grease fittings make lubrication easy.
ALL PURPOSE UTILITY SUMP . . . Flushing and cleaning tower basin is fast and easy with Dover's exclusive new right angle sump.
FLANGE – ASSEMBLED CELLS . . . Towers larger than 150 ton capacities can be set-up easily and quickly at job site.

DOVER
MANUFACTURING COMPANY
Dept. 100, 3117 Weatherford Avenue
Independence, Missouri

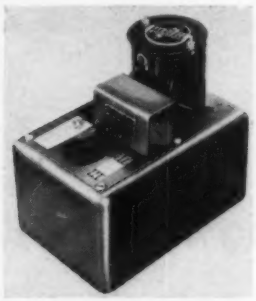
NEW, FREE FOLDER
Send today for your copy of the new Series R silLOWette folder. It's full of details, specifications and drawings of the New Dover silLOWette tower.

EQUIPMENT DEVELOPMENTS

Continued



with air conditioning installations in stores, supermarkets, restaurants, other low ceiling structures, manufacturer says. Available with open, encased blower assemblies providing flexibility in laying out forced air systems of any capacity. Units produced in eight sizes with outputs ranging 50,000 to 230,000 Btu; have gas control lines mounted on either side and low voltage controls operating on either 115 or 230 volt current.



Condensate Pumps . . .

. . . for removing water from air conditioning systems, dehumidifiers — *Hartell, Inc., Dept. HPAC, 60 York Rd., Warminster, Pa.*

Design of "Centriflow" units includes sand cast aluminum reservoirs with integrally cast pump housings. Stainless steel pins attach impellers to shaft. Dimensions including motor are 6 in. wide, 9 in. long, 9 in. high.

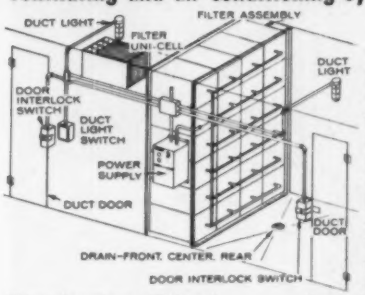
Diamond Drill . . .

. . . for drilling through concrete for installation of piping — *Wink Corp., Dept. HPAC,* 1518 *N.* 117*th St., Milwaukee* 13.

News About Air Filters

NEW HIGH VELOCITY ELECTRONIC AIR CLEANER

for removing dirt particles of sub-micronic size in ventilating and air conditioning systems.



This two-stage electrostatic air cleaner removes smoke, fumes and carbonaceous matter in particle sizes down to 1/100 micron. Handles 50% more air than conventional designs to conserve space and cost of installation. Dirt-cleaning efficiencies range from 85% to 90% at face velocities up to 600 fpm and up to 98% at lower face velocities.

Employs ionizing section to charge air and dirt particles and separate plate section to collect oppositely charged particles which accounts for its high cleaning efficiency and high dirt-holding capacity.

Constant, low pressure drop inherent with this type of cleaner assures consistent rate of air flow to air conditioning systems.

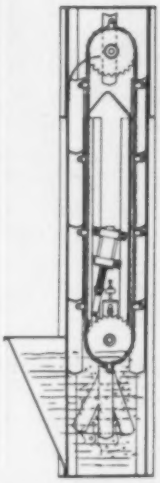
Simple design, utilizing building block construction, eliminates cost and installation of holding frames. Uses selenium rectifier to eliminate need for vacuum tubes.

Provisions made for periodic cleaning with automatic, semi-automatic or manual washing.

Write for Catalog EMC-1055. **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

SELF-CLEANING AIR FILTER

automatic rotating double-wall panel curtain available with air or electric drive.



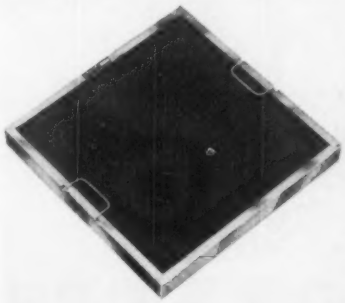
The panels in the Automaze curtain type filter are cleaned and recharged automatically with adhesive. A rotating curtain that holds individual panel filters submerges the panels in an oil reservoir on a timed cycle to dislodge and deposit accumulated dirt in the reservoir. As a result, the Automaze stays clean indefinitely to maintain uniform air flow.

Automaze goes 3 to 6 months without attention, a major improvement over stationary filters that normally need cleaning once a month. Only servicing needed is to remove sludge every six months.

Where compressed air is available, Automaze can be furnished with pneumatic drive. Electric drives are available for standard line current specifications. **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

HIGH VELOCITY AIR FILTER PANELS

all-metal, permanent, washable panels for ventilating and air conditioning systems.



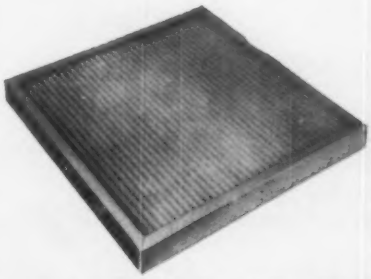
Turboflow action of these filter panels handles 50% more air (up to 3 cfm per square inch gross area) than conventional panels, with high filtering efficiency up to 600 fpm face velocity.

This P-5 Air-Maze panel filter has low static pressure drop, extra large dirt-holding capacity, requires less servicing than ordinary filter panels.

All-metal media of the P-5 has layers of crimped wire screen with "Z" channels stacked 180° to each other so only the nodes touch. Result is a myriad of passages that provide high turbulence by sharp diversions in air stream, causing highly effective wiping action to impinge dirt on adhesive coated baffles.

Write for Bulletin P5-157. **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

NEW DRY-TYPE WASHABLE AIR FILTER



A new air filter by Air-Maze combines the efficiency of a dry, oilless, completely washable panel with a greatly extended filtering surface for longer service life. Has over 8 times the effective surface area of a conventional panel. Especially efficient in removing lint from recirculated air, and for applications where oil vapors cannot be tolerated.

Special screen grids on both sides of filter permit lint to be brushed off several times before washing is necessary. Filter offers complete washability in cold water. May also be cleaned with a vacuum nozzle.

Made of corrosive-resistant materials—aluminum screen and polystyrene-bonded fiber glass media in galvanized channel.

Available in 2" thick panels—16" x 20", 16" x 25", 20" x 20", and 20" x 25" sizes. Write for Bulletin P70P, **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

EQUIPMENT DEVELOPMENTS

Continued

Unit weighs 37 lb, has depth capacities to 200 ft, has rated capacities for core diameters to 6 in. Overhead drive principle allows 10 ft strokes without rechucking drill rod; penetration speeds 1 fpm have been obtained at depths of 100 ft, manufacturer says.

Heat Resistant Coating . . .

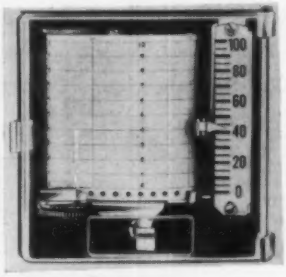
. . .for iron, steel, alloys designed to withstand 1500 F — *Products Development Corp., Dept. HPAC, 824 Connecticut Ave., N.W., Washington 6, D. C.*

"Endura-temp" contains ceramic frits held in suspension in volatile liquid; it air dries to form immediately a tough coating, company says. Data listed for product: 11.5 lb per gal; 600 sq ft coverage per gal; 75 percent solids; less than 1 percent solids retained on No. 325 screen; No. 4 grind solids fineness; 83 KU consistency.

Heating Tape . . .

. . .for industrial use — *Cox & Co., Inc., Dept. HPAC, 115 E. 23rd St., New York 10.*

"Ready-Heat" designed to increase flow of viscous fluids such as bunker "C" oil, grease, stearic acid. Tape does not have to be installed permanently, but can be removed, reinstalled as often as desired, manufacturer says.



Pressure Gage . . .

. . .which records on 3 in. strip chart — *Bristol Co., Dept. HPAC, Waterbury 20, Conn.*

Units offered in ranges 0-3 to 0-60 psi. Recording chassis is interchangeable; may be plugged in without use of tools from front of panel. Several versions of instrument available: one records, indicates on pressure measurement; another records, indicates one while recording second; third version records, indicates one pressure, indicates second.

Another
CAINS
COIL OF PROFIT
PRE-FAB-RIC
A PREFABRICATED FLEXIBLE DUCT CONNECTION
Simply pull out desired length from dispenser-type carton. (It pulls out ready to use.) Roll into round duct or form into square duct and join. Saves 70% time over old methods. DOUBLE-SAFE-LOCKED
A TYPE, SIZE, AND PRICE FOR ALL JOBS
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With every discharge, the valve in a Trerice trap seats in a different position . . . a new seat . . . a steam tight seat every time! Discharging water impinges on the impeller . . . causes rotating action.

EASIER MAINTENANCE

A Trerice trap can be inspected and cleaned without removing it from the line, or disturbing the high pressure bolts and gasket. Removable cap permits quick access to valve and seat for inspection and maintenance.

FREE TRIAL OFFER

We'll supply one, a dozen, or more Trerice steam traps for your operation on a FREE 60-day trial basis. Act now! Write today for bulletin 1400D containing complete engineering data, valve and orifice charts.

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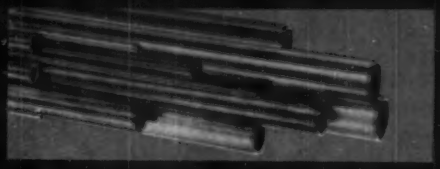
alloy tubing
remember

TEMPER

it should
be tuned
to the task!



The right temper for the task can mean the difference between success or failure, profit or loss. But, relax! Whatever your requirements, specify United seamless copper or copper base alloy tubing. Do so with confidence that the industry's finest quality and production control systems will deliver tubing drawn precisely to your specifications . . . for temper, size, gauge, grain structure, cleanliness, dimensional perfection and cost!

You pay no more for this quality! United tubing, the finest in copper and copper base alloy, is available in coils, straight mill lengths or cut to your specifications.

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Exceptional fuel economy is just one of the features of International WATER TUBE Package Boilers. These rugged hot water or steam generators are guaranteed to operate at a minimum of 81% thermal efficiency. As a result, you get more heat with less fuel—plus these exclusive advantages of water tube boiler design:

- Ample Furnace Volume—low heat release rates
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- Reserve Capacity Always Available
- Rapid Directed Water Circulation
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A fully coordinated, factory fire-tested unit, complete with all necessary controls and combustion equipment for automatic operation. Write for Bulletin 600.

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An International water tube boiler plus the advantages of an approved burner delivered separately, installed and serviced by a local distributor. Write for Bulletin 900.

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Steel Firebox Heating & Power Boilers Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

EQUIPMENT DEVELOPMENTS

Continued

Equipment Briefs . . .

FRACTIONAL HORSEPOWER MOTOR using new oil wicking material — *Westinghouse Electric Corp., Dept. HPAC, Box* 2099, *Pittsburgh* 30. With new cellulose fiber material, motors are shorter but continue to operate five years or more without lubrication, company says. "Permawick" has grease-like appearance, may be inserted in motor end shields like grease.

POTENTIOMETERS with standardized, interchangeable slidewires, calibration resistors — *Bristol Co., Dept. HPAC, Box* 1790, *Waterbury* 20, *Conn.* New feature allows range on "Dynamaster" recorder or controller to be changed quickly, accurately if instrument is shifted from one application to another, manufacturer says.

DISPOSABLE CARDBOARD REELS for holding copper tubing for air conditioning uses — *Chase Brass & Copper Co., Dept. HPAC,* 236 *Grand St., Waterbury* 20, *Conn.* New reels may contain single length of tube 2000 to 3000 ft long in ¼-⅜ in. outside diameters; 1500 to 200 ft in ½ in. outside diameters. Efficient inventory control possible with use of product, company says.

SPLIT IMAGE TRANSIT to indicate level, needed correction — *Hopkins Mfg. Corp., Dept. HPAC, Emporia, Kan.* Unit measures incline down to thinness of dime at 25 ft, company says. Manufactured of plastic, metal, protected mirrors.

DOUBLE WINDOW UNIT manufactured from two panes of sheet glass — *Libbey-Owens-Ford Glass Co., Dept. HPAC,* 608 *Madison Ave., Toledo* 3. Unit has nominal air space between sheets of 3/16 in.; overall thickness slightly under ½ in. Available in 14 to 38 in. width, to 62 in. height, with maximum total area of 1440 sq in. ∓

GILSULATE® Pipe Insulation Digest

FOR UNDERGROUND HOT PIPES

Analyze costs of seven insulation systems

Case Tech chooses Gilsulate

When one of the nation's top technical schools selects your product after long laboratory and field tests you have a right to be proud.

We're doubly proud of Gilsulate: it's been chosen by Case Institute of Technology in Cleveland as the underground hot pipe insulation for its major expansion program—and for rehabilitation of all steam distribution systems on the campus as the need arises.

Case is only one instance of major Gilsulate installations at leading schools, colleges, training centers and other large institutional centers. You will also find Gilsulate protecting underground hot lines in every type of industry, in all parts of the country.

The trend is to Gilsulate. Write for complete details and learn why.

300-FOOT REPLACEMENT LINE going in at Case. Note forms around pipe to conserve Gilsulate.

GILSULATE IS THE SIMPLEST TO INSTALL of any underground hot pipe insulation. An illustrated wall chart, "How To Install Gilsulate," showing the 10 simple steps to follow, has been prepared. We will be glad to send you a copy on request.

How to select underground hot pipe insulation

There are at least 11 important points to look for in choosing insulation for underground hot piping systems. Users' experience with Gilsulate and other insulations under all and varied conditions proves that Gilsulate can out-perform all others. The 11 points are:

1. High resistance to both conductive and radiant heat flow.
2. Stable and non-corrosive in air, acid and alkaline soils, and salt water.
3. Good dielectric.
4. Moisture-proof and vapor-proof *without* jacketing or sealing.
5. Uses readily available materials both in manufacture and installation.
6. Easy and rapid to install, with a minimum of skill and effort.
7. Structural stability under vibration, dead and live loads, during shipping, storage, installation and operation.
8. Adaptable through a wide range of temperatures.
9. Allows pipe to expand and contract.
10. Allows system to be repaired and altered easily.
11. Allows piping leaks to be detected readily.

Gilsulate costs less per installed linear foot than *seven* different types of underground distribution systems, according to a report given by R. D. Hummel at the annual meeting of the National District Heating Association. Mr. Hummel is Manager, Division of Engineering, Yale University.

Based on installations of 1,000 feet of 8-in. welded steam line, and 4-in. welded return, Gilsulate costs $27 per linear foot, including the pipe, digging and insulation. The table below lists the systems compared, and costs.

System	*$Cost/ft.*
Gilsulate	27
Product A, with concrete fill	32
Tile conduit; pipe insulated with magnesia, and wrapped	32
Pipe insulated with magnesia and having metal jacket with protective coating	32
Reinforced concrete pipe over concrete slab, with wrapped magnesia insulated pipe	35
Precast slab envelope with magnesia insulated pipe within	42
Walk-through tunnel with magnesia insulation on lines	120

Here again is convincing proof that poured-in-place Gilsulate drastically cuts underground hot pipe insulation costs, with top corrosion protection and thermal efficiency. Gilsulate's high resin content, water-repellent properties, resistance to all corrosive elements normally found in soil, and high insulating value are unique. No wonder Gilsulate is the ideal—and most economical—solution to underground hot piping insulation problems!

Note: A complete account of Mr. Hummel's talk will be found in the Spring 1957 issue of PIPE INSULATION NEWS, available on request.

American Gilsonite Company

134 West Broadway, Salt Lake City 1, Utah
Eastern office: 3537 Lee Road, Cleveland 20, Ohio
Distributors in principal countries of the world
Affiliate of Barber Oil Corporation and Standard Oil Company of California

All of these items appeared in PIPE INSULATION NEWS. To keep abreast of money-saving hints and developments in underground hot pipe insulation, ask to be put on our mailing list.

Greatly increased "human load" easily offset by KOOLSHADE®

—costly air conditioning change is eliminated

Problem: Investors Syndicate Corporation, new tenants on the first floor of the WCCO Building in Minneapolis, brought heavier traffic than had previously occurred in the space. The increased "human load" pushed the building's air conditioning needs to 37 tons—more than the existing plant could safely supply. It seemed the system would have to be enlarged or replaced.

Solution: Calculations proved that KoolShade Sunscreen applied to the south windows would cut the requirement to 24.7 tons. This 34% saving of 12.3 tons would bring the load well within the capacity of the existing unit. KoolShade was applied. Not only have general results proved highly satisfactory, but workers near the south windows report marked relief from the sun's heat and glare.

This installation proves again that when unexpected factors render an existing cooling unit inadequate, or when you are remodeling to accommodate air conditioning, or designing a new air conditioned structure, it pays to investigate the savings possible with KoolShade Sunscreen.

Only KoolShade Sunscreen offers

- **unsurpassed shading efficiency**—keeps up to 87% of the sun's rays off windows during the hottest part of the day—100 sq. feet of KoolShade reduces air conditioning approximately 1 ton.
- **80% clear visibility**—admits maximum glareless light.
- **harmony with all architecture**—improves building's appearance.
- **virtually no maintenance**—constructed of strong preoxidized bronze strips, wired and framed together, lasts for years, withstands hard blows.

Send today

for this detailed and illustrated bulletin. And for expert help in cutting costs and sun problems, just request a call from a KoolShade engineer. No obligation or charge.

Distributor franchises still open in many communities for those who qualify.

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We'd like to know more about KoolShade. Without obligation, please send:
☐ Free literature
☐ Free sample

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Company_____
Address_____
City_____Zone_____State_____

RECENT TRADE LITERATURE . . .

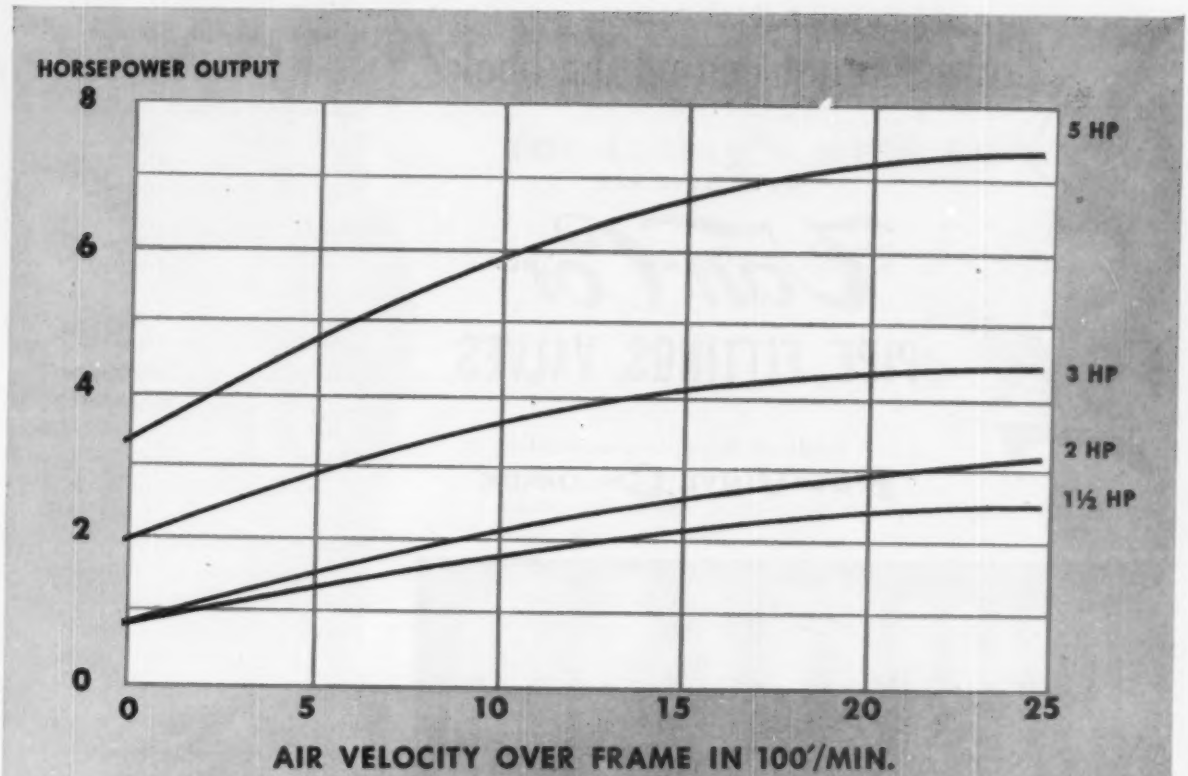
▸ *ADJUSTABLE SPEED DRIVE* — New 12 page booklet 2000 discusses "Select-A-Spede" adjustable speed drive. Unit—5 to 200 hp—is variable voltage d-c drive that uses a-c as power source. Applications in textile, paper making industries discussed. Optional features for special applications, improvements also highlighted. *Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee* 1.

▸ *AIR PURIFICATION IN HOSPITALS* — New 6 page bulletin T-257 discusses use of activated carbon for air purification in hospitals. How activated carbon can keep hospital rooms free of contaminating, irritating vapors described by manufacturer. Use of carbon also saves heat in winter, cooling in summer by recirculating air, company says. *Barnebey-Cheney Co., Dept. HPAC, Cassady at E. Eighth Ave., Columbus* 19, *Ohio.*

▸ *ASBESTOS GASKETS* — New 8 page bulletin describes homogeneous compressed asbestos sheet packing, gaskets. Chemicals that may be handled safely by gaskets cut from single formula material listed. Tables give stock sizes of sheets. *Durabla Mfg. Co., Dept. HPAC,* 114 *Liberty St., New York* 6.

▸ *ASME CODE INDEX* — New 4 page ASME code index provides information on locating design data often referred to by pressure vessel designers. *Downingtown Iron Works, Inc., Div. Pressed Steel Tank Co., Dept. HPAC, Wallace Ave., Downingtown, Pa.*

▸ *BRAZING* — New engineering data sheet 14 describes materials for control of brazing alloy flow. Information given on "Green Stop-Off," "White Stop-Off," "Nicrobraz Stop-Off" mixtures. Function, use proper-



SAVE 15% AND MORE ON FAN MOTORS

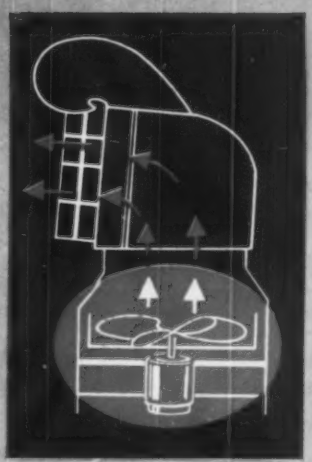
You can get as much as 50% more horsepower at no extra cost by using Reliance Air-Over Motors to drive fans and ventilators.

Reliance has developed a new line of totally-enclosed motors for fan service. These motors produce more horsepower when mounted in the air stream of the driven fan. Reliance Air-Over Motors will develop as much as 50% more than rated horsepower by utilizing the cooling effect of the fan's air flow.

These new Reliance Motors will save you money. By purchasing a lower horsepower rating you can save more than 15% and still meet job specifications.

Reliance Air-Over Motors are available from ½ through 40 horsepower—720, 900, 1200, 1800, or 3600 rpm. Common horsepower ratings are available from stock.

B-1547



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AND ENGINEERING COMPANY

DEPT. 362A, CLEVELAND 17, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO

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Corrosion got you on the hook?

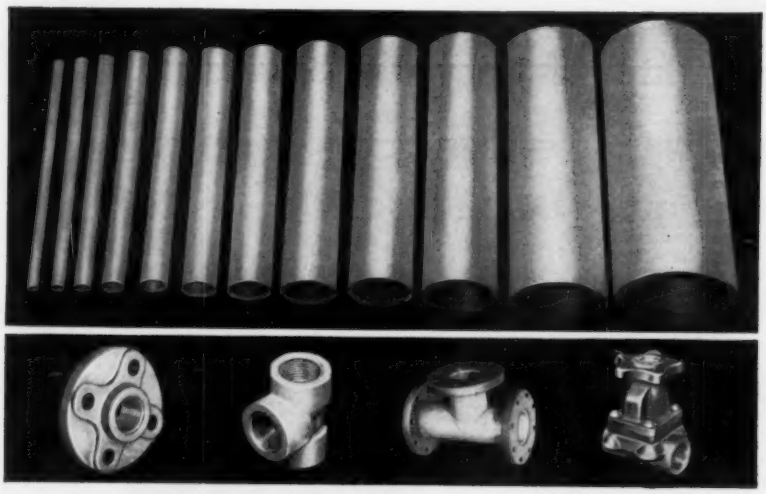
INVESTIGATE

Van-Cor

PIPE, FITTINGS, VALVES

made of Rigid, Unplasticized

POLYVINYL CHLORIDE



ADVANTAGES:

Resists Corrosion of Hundreds of Industrial Acids & Alkalies
Light in Weight (½ that of Aluminum)
Easily Installed; High Tensile Strength; Low Flow Resistance
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AVAILABLE FORMS:

Pipe: ¼″ thru 12″ diam. (10 or 20 ft. lengths)
Fittings: ¼″ thru 12″
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Sheets: 1/16″ thru 2″ (48″ x 96″)
Bar Stock: ¼″ thru 2″ (10 ft. lengths)
Custom Fabrications
Custom Extrusions

Request Complete Catalog containing detailed specifications, diagrams, flow charts, chemical resistance tables and installation data.

INDUSTRIAL DIVISION OF...
COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO

RECENT TRADE LITERATURE

Continued

ties, solvent of each listed. Application techniques discussed. *Stainless Processing Div., Wall Colmonoy Corp., Dept. HPAC,* 19345 *John R St., Detroit* 3.

▸ *CENTRIFUGAL FANS* — New 4 page booklet describes construction, specifications, operation of centrifugal fans for heating, ventilating, air conditioning systems. Nine models feature airfoil, flat, curved bladed wheels; produce air movements 440 to 1,244,332 cfm, company says. Wheels designed for operations requiring maximum efficiency, low noise levels. *Chicago Blower Corp., Dept. HPAC,* 9863 *Pacific Ave., Franklin Park, Ill.*

▸ *CLAY TILE* — New 4 page bulletin prepared as guide for contractors in selection of vitrified clay pipe, fittings for drainage lines. Illustrations show recommended practices of installing, handling, storing products. "Wedge-Lock," "Slip-Joint," conventional bell and spigot joints also described. *Robinson Clay Product Co., Dept. HPAC,* 65 *W. State St., Akron* 9, *Ohio.*

▸ *COMPRESSED AIR FILTERS* — New 4 page bulletin 502 describes air, steam cleaners. Units operate without use of moving parts, filters, baffles, company says. Tables show sizes of "Hi-eF" air, steam cleaners to be installed at various air, gas, steam flows. Specifications, piping hookups, other technical data included. *V. D. Anderson Co., Div. of International Basic Economy Corp., Dept. HPAC,* 1935 *W. 96th St., Cleveland* 2.

▸ *CONTROLS FOR PRESSURE, pH, VISCOSITY, ETC.* — New 12 page bulletin 106 explains applications of automatic and limit "Versatrol" circuits including new "Load Sentry" overload control. Units built around contact meter relays of almost infinitely variable sensitivities, operating directly from any electrical

How do YOU lay out the heating and ventilating for today's new schools?

Who, ME?

Every schoolhouse architect and consulting engineer has probably heard about the sizable reductions in school building costs that have been effected by the introduction of the Nesbitt Series Wind-o-line System of heating, ventilating and natural cooling.

Not all are completely familiar with the layout and application of this unique system—which offers the highest standard of classroom thermal comfort of all such systems *plus* savings of 20% or more of the construction, equipment and installation costs entailed by the conventional system with pipe trenches and runouts.

Nesbitt is most anxious for you and any of your staff to be acquainted with the new and different, but not difficult procedures employed in the layout of the Nesbitt Series Wind-o-line System. We not only offer catalogs and engineering data, but we invite correspondence, and will even arrange conferences in your office, if desired. Thus, your clients can come to know the satisfaction and economy—and you, the good will and prestige—that result from the installation of Nesbitt Series Wind-o-line.

Write us your questions, ask for Publications 104 and 114, or tell us when a Nesbitt representative may see you.

Nesbitt

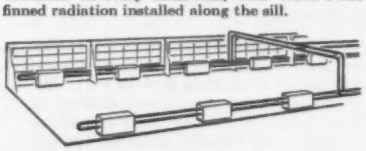
SERIES WIND-O-LINE SYSTEM

MADE AND SOLD BY JOHN J. NESBITT, INC., PHILADELPHIA 36, PA.

Sold also by American Blower Corporation and American-Standard Products (Canada) Ltd.

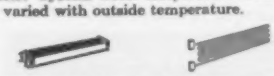
WHAT IS THE NESBITT SERIES WIND-O-LINE SYSTEM AND HOW DOES IT SAVE MONEY?

The system includes a Nesbitt Syncretizer unit ventilator in every classroom, with Wind-o-line finned radiation installed along the sill.

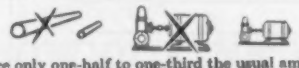


The Wind-o-line copper tubing takes the place of the usual supply and return mains. Two-pipe direct or reversed return circuits are used, with a group of classrooms or even an entire wing of the building in a single circuit. Each classroom is individually controlled.

The Syncretizer multipass heating element extracts the required heat from a smaller quantity of water. System water temperature is automatically varied with outside temperature.

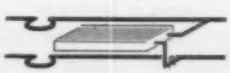


Since Wind-o-line is the main, costly pipe trenches, individual runouts and pipe covering are eliminated. Remaining mains are smaller and shorter.



Since only one-half to one-third the usual amount of hot water is circulated, smaller, less costly pipes and pumps are used.

Packaged piping within the Syncretizer—crossover tubing, expansion loops, balancing valves, etc.—saves expensive jobsite fitting.

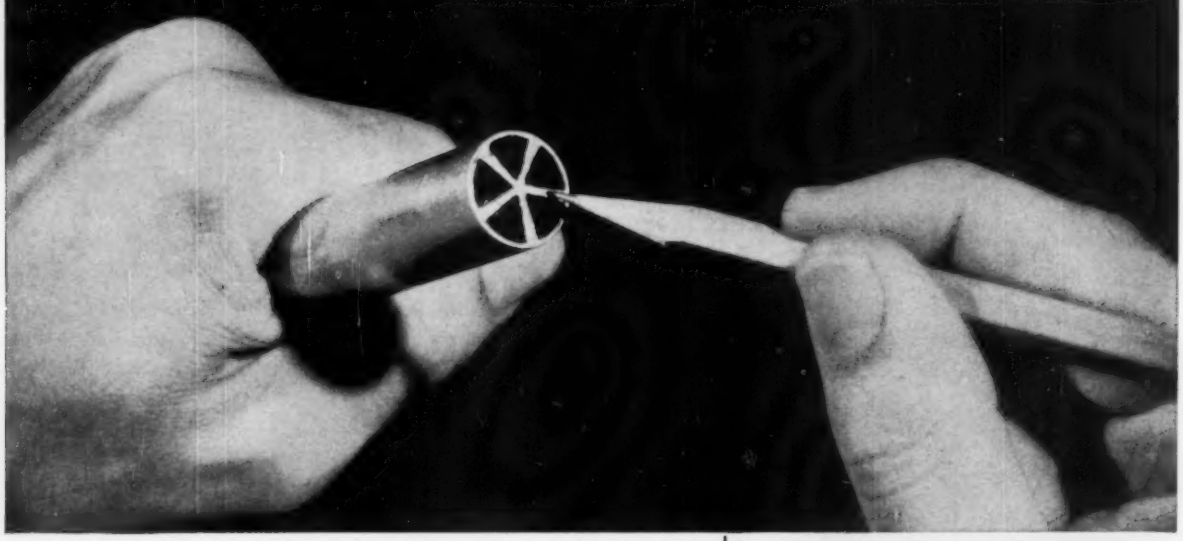


Wind-o-line protects against window downdraft and cold surfaces for as long as necessary, thus completing the protected learning environment.

Wind-o-line gravity heat gives overnight temperature protection without other special controls.

Total savings enable even low-budget schools to have the last word in heating and ventilating.

This STAR FEATURE of the new *Acme* DRY-EX® gives you a SMALLER, LIGHTER, MORE EFFICIENT LIQUID CHILLER



25% more cooling capacity per cubic foot

After years of research and testing, Acme announces a new and important advancement—the first real innovation in direct expansion liquid chiller design since Acme's introduction of the original Dry-Ex in 1937. A new copper tubing with a star-shaped aluminum insert* more than doubles the effective heat transfer surfaces between water and refrigerant. This makes the new Dry-Ex the first liquid chiller designed specifically for today's refrigerants. Combined with all the proved advantages of Acme's thru-tube construction, the star-insert tubing makes the new Dry-Ex smaller and lighter, with 25% more cooling capacity per cubic foot than ever before possible.

Acme's new aluminum insert provides *clear* passages for the *flow* of refrigerant so that the pressure drop is minimized. *Imbedded* in the *walls* of the tubes by a cold-drawing process, the aluminum establishes molecular contact with the copper for perfect heat conductivity.

Whether it's an air conditioning or a process chilling application, the new Dry-Ex will allow you to build a more compact system — one that is economical to install and operate. Dependability is assured. The new Dry-Ex incorporates all the proven construction features that have made the Dry-Ex the leading product in its field since originated by Acme in 1937.

*Patent applied for

ACME INDUSTRIES, INC. JACKSON, MICHIGAN

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

New selection procedure simplifies your engineering task

Send me the complete new catalog on Dry-Ex Liquid Chillers.

Name..... Title.....

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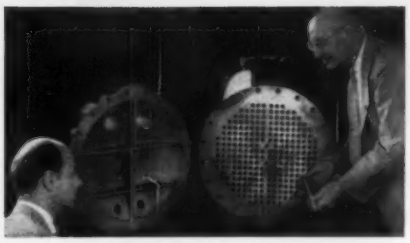

PROVEN THRU-TUBE EFFICIENCY MAINTAINED

Acme's star-shaped aluminum insert tubes of the new Dry-Ex extend straight through to multi-pass heads at each end. No bends, no *soldered* joints — no leaks! High refrigerant velocity is maintained and controlled to achieve greater chiller efficiency, lower pressure drop and more positive oil return than is possible with any other construction.

CHILLER SIZE AND WEIGHT REDUCED SIGNIFICANTLY

Diagram shows typical reduction in chiller diameter made possible by the greater heat-transfer capacity of Acme's new Dry-Ex. Because of their smaller size, these chillers fit into closer spaces, are easier for the contractor to handle and install. Reduced weight saves freight costs and smaller cubic content of refrigerant and water means a smaller refrigerant charge, less load on floors and and mounting structures.

RECENT TRADE LITERATURE

Continued

signal, manufacturer says. *Assembly Products, Inc., Dept. HPAC, Chesterland* 1, *Ohio.*

▸ *CONTROL VALVES* — New 6 page booklet 307 gives information on series "30" balanced, single seated, tight closing control valves. Units designed to render maximum service with minimum maintenance, company says. Flow characteristics, dimensional, weight charts together with seven illustrations included. *Schade Valve Mfg. Co., Dept. HPAC,* 2527-37 *Bodine St., Philadelphia* 33.

▸ *CONVERSION CHART* — Included on new chart are common conversions such as inches to centimeters; watts to horsepower; atmospheres to kilograms per square centimeters; centimeters per second to miles per hour; cubic feet to liters; microns to meters. Useful to engineers, shop men, executives, company says. *Precision Equipment Co., Dept. HPAC,* 4411*E Ravenswood Ave., Chicago* 40.

▸ *CORROSION CONTROL* — New bulletin describes filming type amine for controlling corrosion in steam condensate systems. Benefits of product in removing iron oxide deposits, increasing heat transfer, reducing maintenance costs, protecting steam condensate systems during standby periods pointed out by company. Corrosion reduction chart demonstrates how corrosion may be cut in 10 different applications. *Hagan Chemicals & Controls, Inc., Dept. HPAC, Hagan Bldg., Pittsburgh* 30.

▸ *DEHYDRATORS* — New bulletin SC-1013 describes dehydrators designed to meet specific needs for removal of moisture from most gases. Gas inlet pressures may range from few lb gage to 150 psig for standard design to 3500 psig or more for special applications, company says. Gases handled include carbon dioxide, carbon monoxide, hydrocarbons, nitrogen, oxygen, natural gas, hydrogen, etc. Illustrations provided. *Selas*

Which of these ventilation problems do you want solved?

General ventilation and comfort cooling? Removal of fumes, dust, heat and steam? Air circulation, rapid product cooling and drying?

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solves it these 5 ways surer:

1. Complete line: Broadest product line of air-moving equipment for every industrial requirement.

2. Certified performance: All Power Line Fans are rated by PFMA and NAFM.

3. Backed by 33 years of specialization in manufacture of highest quality ventilation equipment.

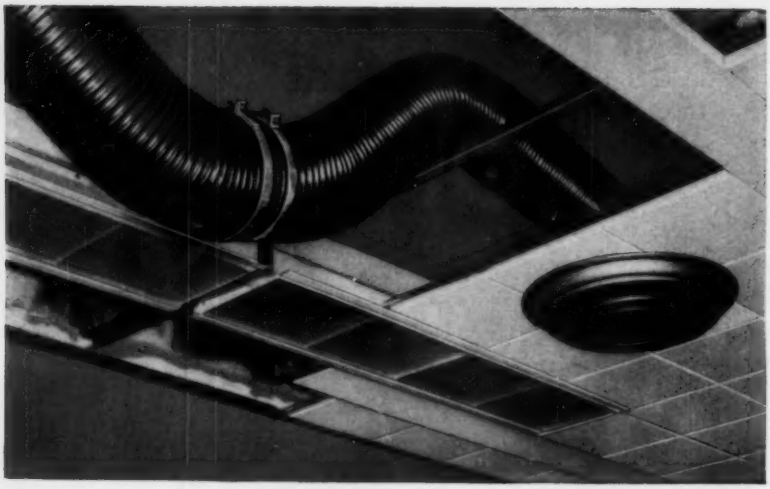
4. Competitively priced to give you important cost savings in initial investment and in maintenance. You get the precisely right product to fit your requirements. You don't over-buy with equipment too large or under-buy with equipment too small.

5. Sold only through qualified ventilation specialists. You get expert technical advice and service from the survey of your requirements right through to the completion of your installation.

YOURS ON REQUEST: Big 20-page Power Line Catalog gives complete facts about industrial ventilation, including selection of proper type and size of fan, calculation of dust resistance, and installation procedures, plus features, dimensions, specifications and performance data. Without obligation write for your free copy of Catalog No. 64A.

POWER LINE FAN COMPANY, INC.

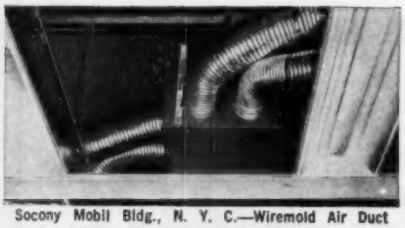
Subsidiary of **Chelsea Products, Incorporated** 639 South Avenue, Plainfield, New Jersey



Indiana Nat'l Bank Bldg., Indianapolis—Wiremold Air Duct runout from branch duct to ceiling diffuser.

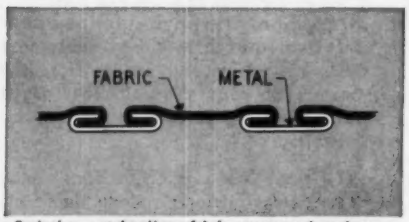
READILY RELOCATED

Flexibility of Wiremold Air Duct lets you move diffusers anywhere, anytime



Socony Mobil Bldg., N. Y. C.—Wiremold Air Duct "octopus" in a high-velocity air conditioning system.

Cuyahoga County Bldg., Cleveland—Wiremold Air Duct connects hot and cold risers to underwindow units.



Exclusive construction—fabric component and supporting steel spiral are mechanically interlocked.

Wiremold Air Duct, the flexible connector, helps make air conditioning systems versatile. It provides a simple way to adjust for any variations from initial plans, or changing tenant requirements. And both diffuser and Wiremold Air Duct can be moved without disturbing permanent equipment.

Made by an exclusive process that mechanically interlocks the fabric with the supporting steel spiral, there is no glue to dry out and cause duct failure. As a result, Wiremold Air Duct provides long life and good performance. Its light weight makes it easy to handle — especially important in cramped quarters.

other advantages

- good air flow with minimum pressure loss
- no air leakage at normal operating pressure
- meets National Board of Fire Underwriters requirements
- compensates for misalignments between connections
- allows for future relocation of units
- acts as a vibration damper
- easy to cut, fit and install

SEND FOR FOLDER NO. 591 for further information on Wiremold Air Duct.

WIREMOLD® FLEXIBLE AIR DUCT

THE WIREMOLD COMPANY, HARTFORD 10, CONNECTICUT

RECENT TRADE LITERATURE

Continued

Corp. of America, Dept. HPAC, Dresher, Pa.

▸ *DIFFUSERS, REGISTERS, GRILLES* — New 64 page catalog 58 shows line of company's diffusers, registers, grilles. Illustrations, selection charts, engineering data included. *Air Control Products, Inc., Dept. HPAC, Coopersville, Mich.*

▸ *DRAFT CONTROL* — New bulletin describes draft control that can be operated with coal, oil, gas installations. Unit controls draft in firebox during "off" periods, opens damper before re-starting burner, switches to automatic draft control during burner operation, manufacturer says. Diagrams, illustrations provided. *Plant Equipment Div., General Blower Co., Inc., Dept. HPAC, 6412 Girard Ave., Philadelphia.*

▸ *DUST CONTROL* — New 32 page catalog 951-D covers company's line of air cleaning machines including wet blast, air blast, dust control equipment. Cast steel shot and grit abrasives, sandcutters, core rod straighteners also included. Heavy duty, high efficiency batch type centrifugal blast cleaning machines in three sizes described. *Wheelabrator Corp., Dept. HPAC, 1321 S. Byrkit St., Mishawaka, Ind.*

▸ *ELECTRIC MOTORS* — New 4 page bulletin B-2506 discusses a-c motors 1 through 125 hp. Units available in protected, fan cooled enclosures said to be corrosionproof, explosionproof. Company says operation possible within 40 C temperature rise. *Reliance Electric and Engineering Co., Dept. HPAC, 24701 Euclid Ave., Cleveland 17.*

▸ *FAN RATING PROGRAM* — Bulletin 153-57 entitled *AMCA Certified Ratings* gives details of new industrywide program designed to aid specifiers of air moving equip-

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RECO hot water storage heaters and tanks were designed to meet and beat these hot water needs. Twenty-nine pieces of RECO heat exchange equipment will keep thousands of gallons of hospital-pure hot water always on tap for the new 800-bed center. Hundreds of hospitals from coast to coast now rely on round-the-clock hot water service by RECO.

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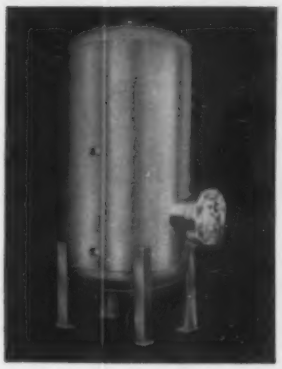
For name of nearest RECO representative, write Dept. R, RECO, 7th & Hospital Sts., Richmond 5, Va.



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Pantex SPEEDYLECTRIC STEAM GENERATOR

Ideal Answer to
10 PROBLEMS
in Supplying Steam

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In many such situations, a Speedylectric Steam Generator is the best or only solution. Using the electrode method of generating steam electrically, completely safe anywhere, its design eliminates low-water hazard and practically removes the need for supervision. Generation is fast, by the simplest and most economical electric method, and adjusts automatically to meet load demand. Upkeep is nil . . . there are no coils, tubes or heating elements to scale or burn out. Sizes from 2 to 50 Bhp, 15 to 500 psi. Higher pressures are available. Electric power 220, 440, or 550 volts A. C. UL listed, ASME code.

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RECENT TRADE LITERATURE

Continued

ment to identify products certified to perform according to published performance ratings based on official tests. Typical test setups, performance curves for fans included. Requirements for qualifying products, laboratories also provided. *Air Moving and Conditioning Association, Inc., Dept. HPAC,* 2159 *Guardian Bldg., Detroit* 26.

▸ *FERROUS METAL TUBING* — Separate phases of ferrous metal corrosion described in new 12 page booklet TR-548. Articles describe on the site conditions that affect corrosion, modern weapons required to attack sulfide, pitting corrosion on steel, how to prevent stress corrosion cracking. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *FILTER CLOTH BAGS* — New pamphlet describes filter cloth bags available with polyethylene zippers. Applications for bags include leaf filters, air ducts, dust bags, tank covers, related equipment, company says. Drawings, diagrams of zippers provided. *Filtration Fabrics Div., Filtration Engineers, Dept. HPAC,* 155 *Oraton St., Newark* 4, *N. J.*

▸ *FLUX* — New bulletin 17 discusses "Nicrobraz" flux for high temperature brazing applications. Properties, uses of product described; application techniques provided. *Wall Colmonoy Corp., Dept. HPAC,* 19345 *John R St., Detroit* 3.

▸ *GAS WELDING* — New 36 page welding equipment catalog 160 covers applications of company's line of oxyacetylene welding, cutting torches. Air acetylene torches, machine cutting torches, welding regulators, industrial regulators, pressure gages, tank couplings, adaptors, hose connections also discussed. *Modern Engineering Co., Dept. HPAC,* 3409 *Pine Blvd., St. Louis* 3.

▸ *GLASS PIPE* — New 8 page bulletin PE-30 lists features of glass pipe

Install Insulation with
TUFF-BOND
Super-Strength Adhesives

TUFF-BOND #7
. . . fire-retardant adhesive for installing insulation

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NEW MULTI-VENT® "*INDUSTRIAL*" AIR DIFFUSER DELIVERS DRAFT-FREE AIR AT LESS THAN 2½¢ per CFM!

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This means not only draft-free comfort for workers, but also consistently low rates of air motion which will not interfere with production. In addition, the even air distribution delivered by MV-100 can maintain temperature variation within 2 degrees . . . an important factor in "process cooling" for many industries.

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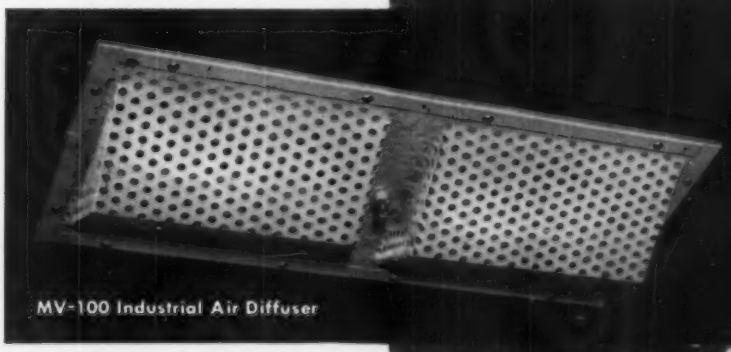

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RECENT TRADE LITERATURE

Continued

for drainlines. Product said to be resistant to variety of chemicals, acidic materials, organic solvents. Seventeen illustrations, charts included. Various pipe fittings shown. *Corning Glass Works, Dept. HPAC, Corning, N. Y.*

▸ *HIGH TEMPERATURE FANS* — New 20 page booklet HF-100 contains information on industrial high temperature "Dura-Temp" heat fans. Among features of units described are all welded housing, fabricated steel bases, heat resistant antifriction bearings. Illustrations, charts, diagrams provided. *General Blower Co., Dept. HPAC, 8618 Ferris Ave., Morton Grove, Ill.*

▸ *INDUCED DRAFT FANS* — Three bulletins contain specifications, information on induced draft fans for heating and industrial boilers. They are: E-104, *Selection Table for Heating Boilers;* E-103, *Selection Table for Industrial Boilers;* G-242, *Dimensional Data.* New units maintain proper draft under all conditions, providing adequate air for combustion at required rate of flow of gases through boiler, manufacturer says. *Plant Equipment Div., General Blower Co., Inc., Dept. HPAC, 6412 Girard Ave., Philadelphia 31.*

▸ *INDUSTRIAL CONTROLS* — Two bulletins, AC-3 and AC-4, describe 11 recently developed control devices. First booklet discusses phase fault finders, peak demand limiters, viscosity controls, automatic temperature controls, bearing monitors, multipoint temperature scanners. Other bulletin has information on combined multipoint temperature scanner alarm, control unit. *Tipptronic, Inc., Dept. HPAC, Chagrin Falls, Ohio.*

▸ *INDUSTRIAL HEATER* — New 26 page bulletin 750A describes construction, application, performance features of "Herman Nelson" industrial heater. Thirteen performance graphs, charts pertaining to steam capacities, air flow resistance, other

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NO JOB WAITS FOR

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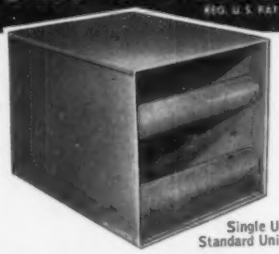

Single Unit
Standard Uni-Silencer

THE NEW SILENCER FOR AIR CONDITIONING AND VENTILATING SYSTEMS

UNI-SILENCERS* and UNI-RESONATORS* have been designed specifically to reduce the airborne noise generated by fans in industrial ventilating and air conditioning systems.

Low in cost from both the original purchase and installation view, Uni-Silencers are delivered in cartons weighing about 75 lbs each. They may be easily and inexpensively transported into the building, to the specific location required.

UNI-SILENCERS* compare favorably in cost with conventional duct lining.

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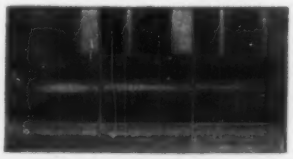

UNI-SILENCERS* are supplied in 3 sizes: Full Unit-24x24x32": Half Unit-12x24x32": Quarter Unit-12x12x32".

UNI-SILENCERS* are sold on a guaranteed basis. Interior and exterior surfaces are smooth, made of perforated and unperforated metal to reduce resistance to a minimum.

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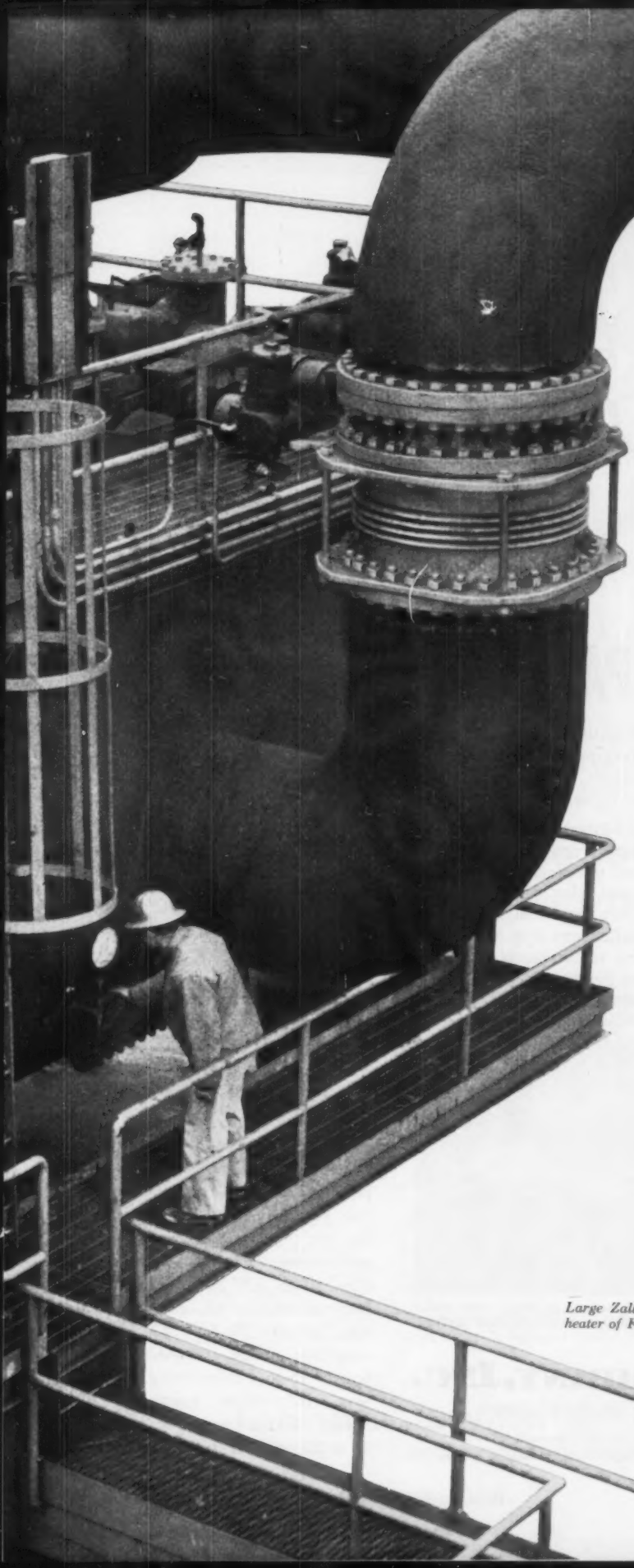

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ZALLEA NON-EQUALIZING EXPANSION JOINTS . . .

Zallea Non-Equalizing Corrugated Expansion Joints offer a degree of protection that can't be equalled for absorbing movement of piping due to temperature changes. They protect interconnected equipment by absorbing movements in otherwise rigid piping systems. They are used in low pressure and vacuum lines . . . between stills, tanks, columns, condensers, pumps and similar equipment.

Standard Sizes: 3″ to 72″ dia.; Special sizes to 50 ft. dia. Pressures: Vacuum to 50 psig. Temperatures: to 1600°F.

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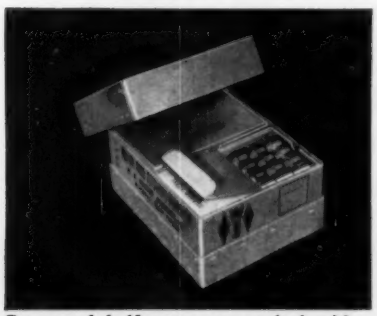

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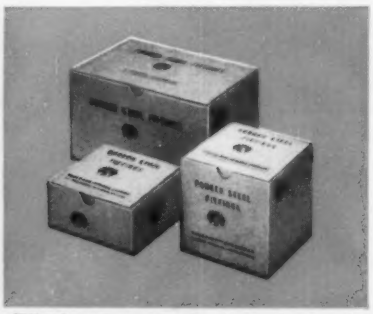

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RECENT TRADE LITERATURE

Continued

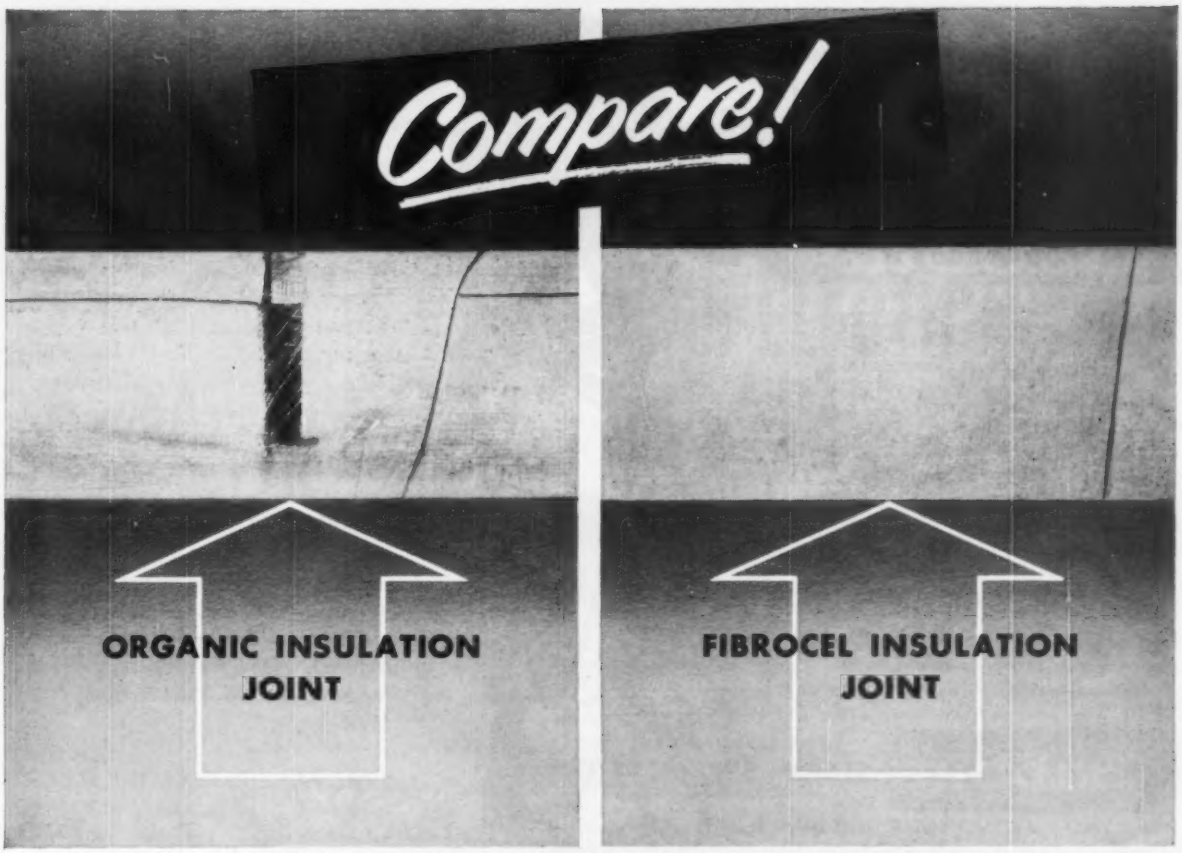
air flow data included. Dimensional diagrams, tables for all models provided. *American Air Filter Co., Inc., Dept. HPAC,* 215 *Central Ave., Louisville* 8.

▸ *INDUSTRIAL THERMOMETERS* — New catalog 125A contains case, socket dimensions; set of standard temperature ranges, scale divisions for industrial thermometers. Companion catalogs that have been revised are: 225A, engraved stem thermometers and hydrometers; 325A, dial indicating and recording thermometers; 425A, general purpose thermometers; 525A, dial indicating and recording pressure and vacuum gages. *Weksler Thermometer Corp., Dept. HPAC,* 195 *E. Merrick Rd., Freeport, L. I., N. Y.*

▸ *INSTRUMENTS* — New 6 page catalog describes instruments for relative humidity and temperature. Design, construction details provided for humidity indicators, recorders, controllers. Hygrometers described include portable, utility models. *Serdex, Inc., Dept. HPAC,* 12 *Bowdoin Square, Boston* 14.

▸ *NEEDLE VALVES* — New 4 page brochure presents information on new "N-20," "N-28" globe type needle valves. Numerous usages to which units may be put described. Technical data in chart form, diagrams included. *Kerotest Mfg. Co., Dept. HPAC,* 2525 *Liberty Ave., Pittsburgh* 22.

▸ *PACKAGED BOILERS* — New 6 page booklet 1241 describes operation of packaged automatic boilers for air, pressure atomizing for oil, gas burning. Model "3" available in sizes 40 to 500 hp equipped with fully modulating oil, gas, combination burners. Model "4" features simplified design, rugged construction in 15 to 100 hp sizes, company says. Information given on 17 boiler sizes in range of pressures 15 to 250 psi. *Orr & Sembower, Inc.,*



Joints are shown after exposure to high humidity and hot-pipe drying action under identical test conditions.

Shrinkage test proves joints *stay tight* with J-M FIBROCEL® Insulation

ONLY FIBROCEL OFFERS ALL THESE ADVANTAGES

No shrinkage—eliminates gaping joints. **Resists compression**—retains full-wall thickness. **Uniform dimensions**—precision formed for exact fit. **Economical application**—lightweight, easy to cut with a knife. **Thermally effective. Permanent**—flame, rot, odor and vermin proof. Developed by Johns-Manville Insulation Research.

A new molded silica insulation developed for plumbing, heating, chilled water and dual service applications in the 35F to 300F temperature range

Fibrocel completely eliminates objectionable shrinkage caused by atmospheric changes!

Tests prove it won't shrink even after moisture exposure and prolonged service under continuous steam flow. This means Fibrocel joints stay tight, with no unsightly gaps . . . messy patching . . . or costly heat loss—ever!

Fibrocel speeds installation, too! It is light in weight and a pleasure to apply. It cuts cleanly, easily with a knife. And its firmness and remarkable dimensional uniformity assure tight, smooth joints . . . and an overall finished appearance that's as neat, round, and true as the pipe itself.

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713-7

Safe, Floor Level OPERATION

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Babbitt

Adjustable
SPROCKET RIM
with Chain Guide

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- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
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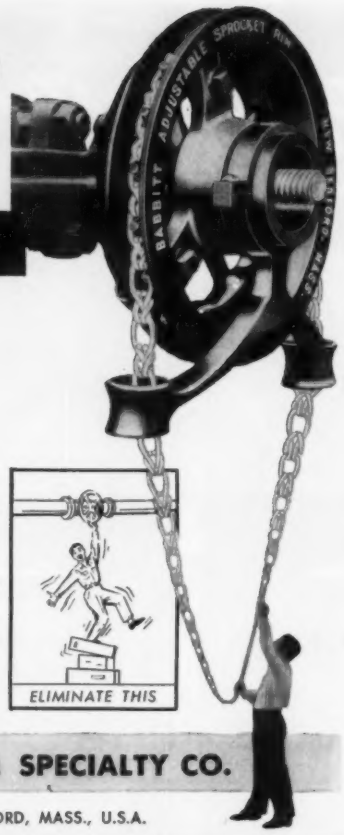
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices



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Tank Heaters
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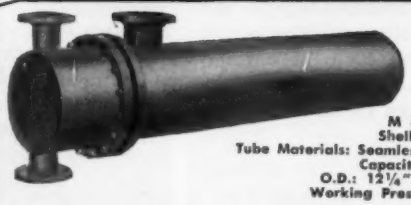

M & L CONVERTER
Shell Material: Steel
Tube Materials: Seamless Drawn Copper
Capacity: 13,200 g.p.h.
O.D.: 12¼" Length: 106½"
Working Pressures: 150 P.S.I.

The above unit is one of several M & L Converters now installed at Idlewild Airport in New York. They were designed and fabricated to furnish the heating system of a hangar with water at 140°F.

In order to meet exact specifications, minor changes were made in standard M & L Converters and one more successful installation went into the record.

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For further details send for your copy of bulletin 780, or we will be happy to send a representative to assist you with any heating or cooling problem.

Manning & Lewis Engineering Company
DESIGNERS & MANUFACTURERS OF QUALITY HEAT EXCHANGE EQUIPMENT
28-42 OGDEN STREET NEWARK 4, NEW JERSEY

M.L

RECENT TRADE LITERATURE

Continued

Dept. HPAC, Morgantown Rd., Reading, Pa.

▸ *PLASTIC PIPE CLAMPS* — New bulletin PP-1057 describes deep slotted screw head, collared head stainless steel clamps for plastic pipe. Among features cited by company: one piece housing of stainless steel; housing recessed flush with inside of clamp; heavy gage band of stainless steel. Selection chart provided. *Wittek Mfg. Co., Dept. HPAC,* 4305-37 *W. 24th Pl., Chicago* 23.

▸ *POWER EXHAUSTERS* — Bulletin 58-A describes manufacturer's line of exhausters with new capacities to 23,000 cfm. Capacity table, specifications for each type of unit included. *Jenn-Air Products Co., Inc., Dept. HPAC,* 1102 *Stadium Dr., Indianapolis* 7.

▸ *PRESSURE REDUCING VALVES* — New 6 page bulletin J-160 gives information on pressure reducing valves designed to give dead end shutoff on fluid services. Features, design improvements, method of operation covered. Flow capacity charts, dimensional drawings, control ranges, material specifications included. *Jordan Industrial Sales Div., OPW Corp., Dept. HPAC,* 6013 *Wiehe Rd., Cincinnati* 13.

▸ *RADIOACTIVE PRECAUTIONS* — New 8 page booklet describes radiological health, safety consulting service of company's nuclear division. Information intended by manufacturer to meet needs of handlers, users of radioactive materials who do not have facilities or trained personnel to adequately monitor their operations. Four illustrations included. *Combustion Engineering, Inc., Dept. HPAC,* 200 *Madison Ave., New York.*

▸ *ROTARY AIR PUMPS* — New 24 page booklet contains detailed blueprints showing actual installations of rotary air pumps used for vacuum, pressure operations. These include lifting, blowing, suction, ex-

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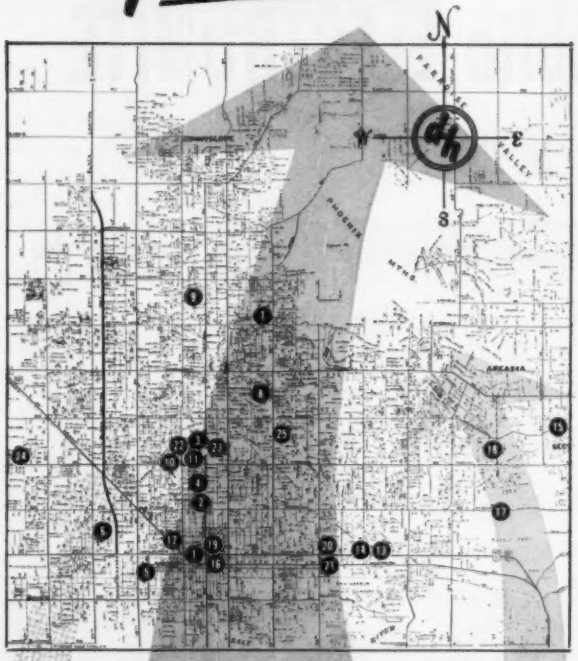

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RECENT TRADE LITERATURE — *Continued*

traction, testing, materials transfer, drying, filling, chucking, feeding, packaging. Other similar air applications covered. *Leiman Bros., Inc., Dept. HPAC, 102 Christie St., Newark 5, N. J.*

▸ *SHAFT COUPLINGS* — Full floating shaft couplings described in bulletin 98. Units used to connect shafts that are spaced far apart; recommended for cooling tower, fan, pump, compressor drives, company says. Other uses outlined. Twelve illustrations, seven diagrams included. *Thomas Flexible Coupling Co., Dept. HPAC, Warren, Pa.*

▸ *SHIP DEHUMIDIFICATION SYSTEMS* — New 16 page bulletin R-30 covers ship dehumidification systems. Chapters describe automatic dehumidification systems, psychrometric ranges for three methods of dehumidification, review of shore dehumidification applications, ship dehumidification methods. Illustrations provided. *Desomatic Products, Inc., Dept. HPAC, 1109 W. Broad St., Falls Church, Va.*

▸ *SLING CHAINS* — New 4 page bulletin describes sling chains in variety of sizes, styles. Assembly, repair data provided. Information presented on working load limits at various angles; basic components required to make slings. *American Chain Div., American Chain & Cable Co., Inc., Dept. HPAC, York, Pa.*

▸ *SOLENOID VALVES* — New bulletins E-228, 229, 230, 231 describe solenoid valves—models 271, 272, 273, 274, respectively. Valves designed for liquid and suction line refrigerant applications, hot gas defrost installations; also for controlling water flow. Units feature moistureproof coil construction, quiet operation, one nut disassembling operation, manufacturer says. Available in several sweat, pipe type connection sizes; rated power consumption ranges 12 to 18 watts. *Controls Co. of America, Dept. HPAC, 2450 N. 32nd St., Milwaukee 45, Wis.*

▸ *SOOT BLOWERS* — New bulletin describes master valve soot blowers for fire tube boilers. Each unit eliminates soot, ash, unburned carbon; treats each boiler tube separately; accomplishes work in approximately 3 min, company says. Among other features cited: 9¾ in. diameter × 7 5/16 in. size, one piece iron constructed body, deep stuffing box, bronze packing gland. *Bate Soot Blower Div., General Blower Co., Inc., Dept. HPAC, 6412 Girard Ave., Philadelphia 31.*

▸ *STAINLESS, TOOL, ELECTRICAL STEELS* — New 14 page booklet lists 20 films covering production, fabrication, end use of stainless, tool, electrical steels and cemented carbides which may be obtained for

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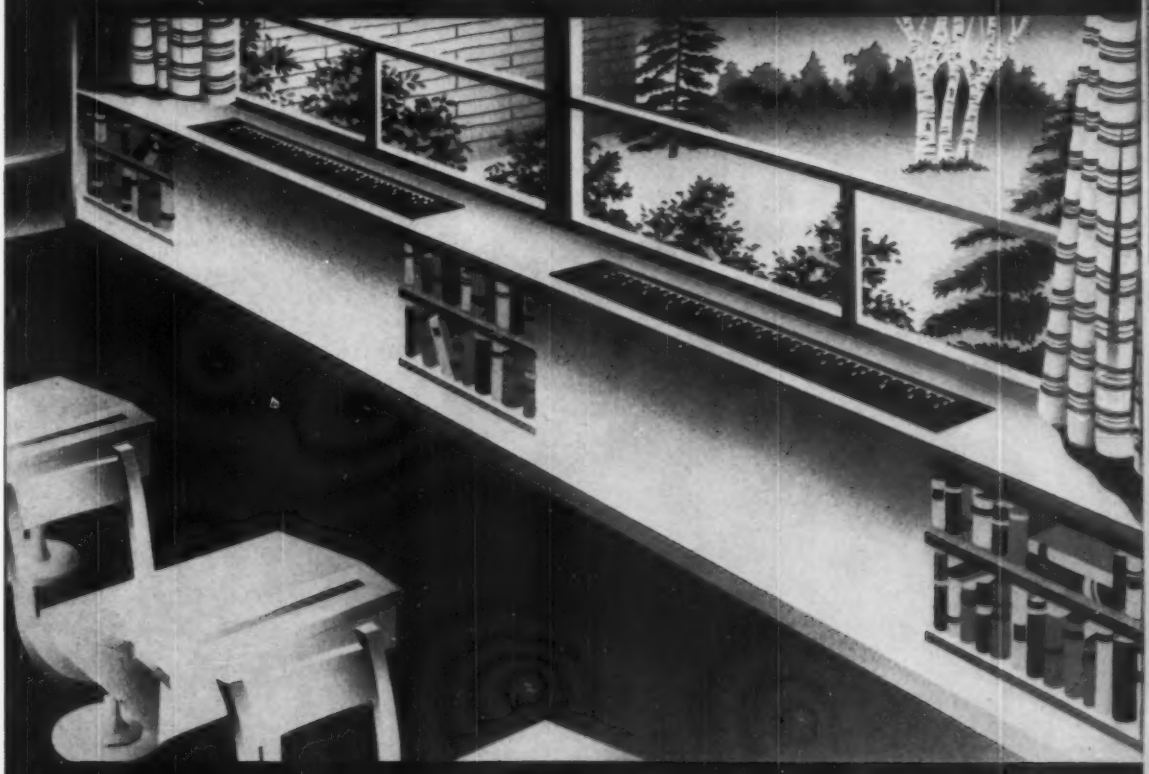

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RECENT TRADE LITERATURE

Continued

showing. All are 16 mm with sound; 18 in color. Lengths range 11 to 32 min. *Allegheny Ludlum Steel Corp., Dept. HPAC, Oliver Bldg., Pittsburgh* 22.

▸ *STEAM BOILER* — New 750 hp standard design steam generator for light, heavy oil and gas described in specification sheet. Unit is of horizontal, two-pass construction with return tubes arranged concentrically around centrally located furnace. Design pressure rated 200 psi. Dimensions are 10 ft 7¼ in. × 9 ft 9 in. × 28 ft with diameter of 8 ft 7½ in. *Cyclotherm Div., National-U.S. Radiator Corp., Dept. HPAC, Oswego, N. Y.*

▸ *STEEL BOILERS* — New 4 page brochure describes steel heating boilers for large structures. Three-pass system extracts full usable heat for steam, hot water; unit is oil, gas, stoker fired, company says. Dimensional, capacity charts provided. Front, back, side view diagrams included. *Portmar Boiler Co., Inc., Dept. HPAC,* 193 *Seventh St., Brooklyn* 15.

▸ *STEEL UNIONS* — New 16 page booklet entitled *What Makes a Good Union?* contains data on steel unions. Information on pressure tightness, installation, interchangeability, sturdiness of units presented. *Clayton Mark & Co., Dept. HPAC,* 1900 *Dempster St., Evanston, Ill.*

▸ *SWING CHECK VALVES* — Rubber lined cushioned swing check valves described in new bulletin W-11. General dimension, specification, installation, operation information provided. *Golden-Anderson Valve Specialty Co., Dept. HPAC,* 1210 *Ridge Ave., Pittsburgh* 33.

▸ *SYNCHRONOUS MOTOR* — Bulletin PB-117 offers technical, operational, design data on new permanent magnet synchronous motor. Specifications include torque ratings, speeds, shaft dimensions in addition to material, construction information. *Cramer Controls Corp., Dept. HPAC, Centerbrook, Conn.*

▸ *TANK AND PIPE LININGS* — New 20 page bulletin CE-50 contains selector charts for tank, pipe linings. General information, tables of properties provided. More than 50 illustrations included. *American Hard Rubber Co., Dept. HPAC,* 93 *Worth St., New York* 13.

▸ *TEMPERATURE CONTROLS* — New 4 page bulletin MC-157 describes "Thermoswitch" designed to help equipment run at faster speeds, require less maintenance, have long life. Inherent sensitivity of unit is 1/10 of 1 F; range to 700 F, company says. Construction details of control, six basic design configurations included. *Fenwal, Inc., Dept. HPAC, Ashland, Mass.*

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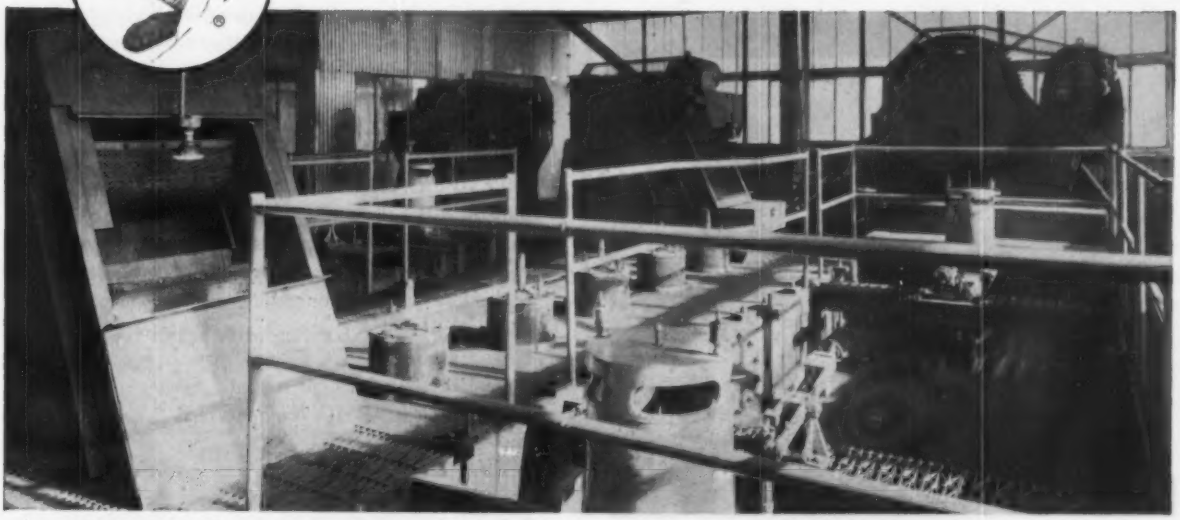

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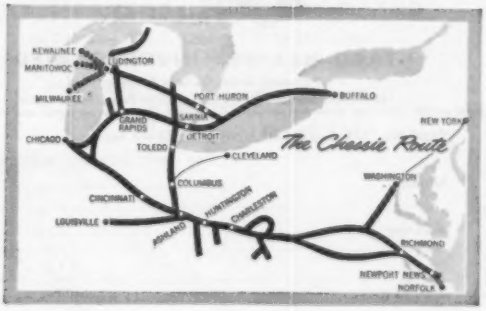

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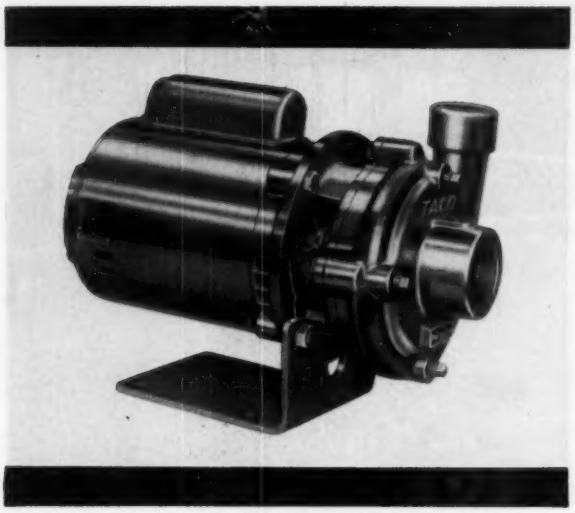
TACO 170



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RECENT TRADE LITERATURE — *Continued*

▸ *TEMPERATURE CONTROL VALVES* — New 6 page bulletin J-180 describes temperature control valves. Features, method of operation highlighted. Sizing charts, dimensional drawings, control ranges, material specifications provided. *Jordan Industrial Sales Div., OPW Corp., Dept. HPAC,* 6013 *Wiehe Rd., Cincinnati* 13.

▸ *TEMPERATURE REGULATORS* — New 6 page bulletin 1012 discusses two series of steam regulating valves with pilots for various types of heat exchangers. "ET-124" series designed for instantaneous heaters, oil preheaters, heating converters, air heating coils. "ET-14" series used for storage water heaters, oil storage tanks, plating tanks, kilns, ovens. Illustrations of typical applications presented. *Spence Engineering Co., Inc., Dept. HPAC, Walden, N. Y.*

▸ *THERMOMETERS* — New pamphlet describes straight form thermometers for use on tops of tanks, boilers. Units offered in ten ranges calibrated in Fahrenheit or centigrade; available in stem lengths 2½ to 72 in., with 3 or 5 in. diameter dials. Each has stainless steel adjustable mounting nut which makes it possible to turn lock head in any position for maximum visibility, company says. *W. C. Dillon & Co., Inc., Dept. HPAC,* 14620 *Keswick St., Van Nuys, Calif.*

▸ *TUBULAR CENTRIFUGAL FANS* — Application of tubular centrifugal fans to air conditioning, ventilation, industrial processes covered in new 16 page booklet TC-1-57. Units are true centrifugals in basic design, operation, company says. Direct drive ratings, dimensions, arrangements, included. Seven certified curve charts provided. *Dryer Electric Corp., Dept. HPAC,* 164-166 *Wallabout St., Brooklyn* 6.

▸ *UNDERGROUND PIPE INSULATION* — New 16 page booklet 37-D-2 describes pipe insulation designed to insulate, protect underground piping carrying steam and condensate, hot water, chemicals. Illustrations of typical installations, technical data, specifications provided. Advantages of product listed by manufacturer. *Insul-Fil Co., Inc., Div. of Miracle Adhesives Corp., Dept. HPAC,* 250 *Pettit Ave., Bellmore, L. I., N. Y.*

▸ *UNIT VENTILATORS* — New illustrated 12 page catalog UV-1157 covers application, design, construction of unit ventilators. Importance of correlating all phases of cooling, ventilating, heating, filtering and their effect in establishing healthful schoolroom climate outlined. Dimensional data, steam and hot water capacity ratings under typical conditions provided for five sizes. *Rittling Corp., Dept. HPAC, Buffalo* 5, *N. Y.*

RECENT TRADE LITERATURE — *Continued*

▸ *VALVES, FITTINGS* — New 20 page catalog presents size, application data for complete line of refrigeration and air conditioning brass valves, accessories, fittings. Recent technical information on relief valves, hermetically fused sight glasses, high capacity heat exchangers presented. Illustrations included. *Superior Valve & Fittings Co., Dept. HPAC,* 1509 *W. Liberty Ave., Pittsburgh* 26.

▸ *VIBRATION CONTROL* — New 4 page booklet K4D gives engineering specifications, performance data for 15 types of machinery vibration control mountings which utilize steel springs, rubber, cork. Selector chart shows recommended, alternate methods of isolation. More than 20 illustrations included. *Korfund Co., Inc., Dept. HPAC,* 48-15 32*nd Pl., Long Island City* 1, *N. Y.*

▸ *WATER SOFTENERS* — "Hot Process" water softeners described in new 24 page bulletin. Information provided on water conditions that make treatment necessary. Subjects covered include reduction of silica; foaming, priming; problems of protection against corrosion. Illustrations show variations of sedimentation tank designs. List of chemical reactions frequently referred to in feedwater treatment provided. *Cochrane Corp., Dept. HPAC,* 3131 *N.* 17*th St., Philadelphia* 32.

▸ *WATER TREATMENT* — Treatment of water in low pressure heating boilers discussed in new bulletin. Operating troubles of boilers caused by impurities in feed water described. Procedure for minimizing damage to boilers and maintaining maximum efficiency given. Subjects covered include corrosion, scale prevention, tube failures, cast iron boilers, treatment of boiler water. *Water Service Laboratories, Inc., Dept. HPAC,* 423 *W.* 126*th St., New York* 27.

▸ *WELDING FITTINGS* — Weights of welding fittings presented in new 4 page booklet. Covered are 90, 45 deg elbows; tees; 180 deg returns; caps; lap joint stub ends; reducers. Sizes range ½ to 36 in. *Babcock & Wilcox Co., Tubular Products Div., Welding Fittings Dept., Dept. HPAC, Milwaukee* 46.

▸ *WELDING SUPPLIES* — New 48 page catalog lists supplies, accessories for gas, arc welding. Information given on ferrous, nonferrous welding rods for oxyacetylene welding; welding and brazing fluxes; aluminum welding fluxes; brazing alloys, etc. More than 100 illustrations provided. *Air Reduction Sales Co., Div. Air Reduction Co., Inc., Dept. HPAC,* 150 *E.* 42*nd St., New York* 17.

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100,000 GALLONS
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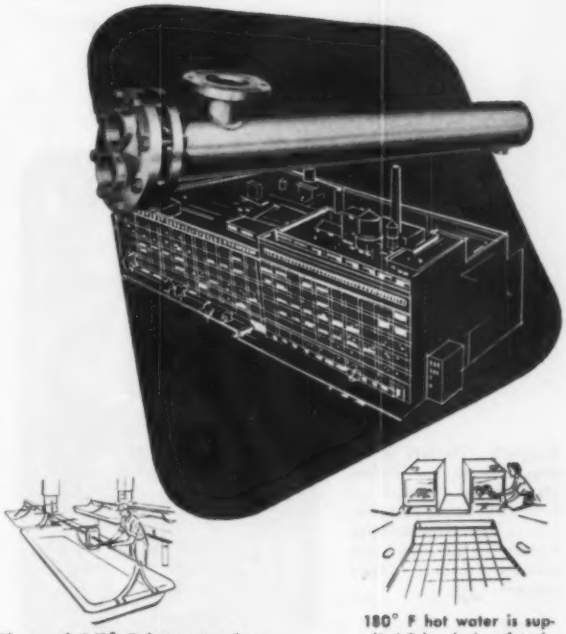

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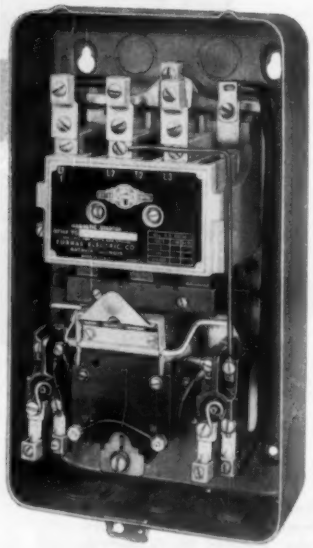
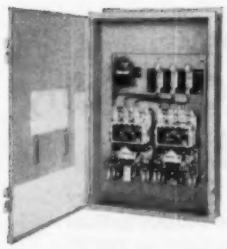


Magnetic Starters in 10 sizes to 100 hp. Furnas starters for control of high horsepower compressors offer the exclusive Furnas "in-between" size starters with dual voltage magnet coils.



Step or Cushion Starting permits the use of larger motors by limiting the inrush current on starting. These methods reduce or completely eliminate objectionable line disturbances due to full voltage across-the-line starting. Furnas Electric offers a complete line of Increment, Auto Transformer and Resistance-type Step Starters.

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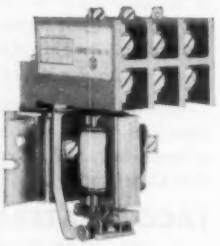

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A42

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WHO'S WHAT...

(New personnel, promotions)

▸ *WESTINGHOUSE ELECTRIC CORP.*—Gwilym A. Price, board chairman; Mark W. Cresap, Jr., president, chief administrative and operating officer; E. V. Huggins, chairman of executive committee of board and vice president; John K. Hodnette, executive vice president; George G. Main, treasurer and vice president of finance.

▸ *WORTHINGTON CORP.*—Admiral Arthur W. Radford, former chairman of the Joint Chiefs of Staff, member of the board of directors.

▸ *RUBEROID CO.*—Thomas H. Dermody, comptroller, elected vice president and comptroller.

▸ *A. O. SMITH CORP.*—Six new vice presidents are Robert F. McGinn, research and development; M. E. Morgan, procurement and traffic; Waldo W. Higgins, engineering; Stanley E. Wolkenheim, marketing; John H. Brinker, "Permaglas" consumer products; John S. Randall, industrial products. Five commercial vice presidents are Walter H. Porth, international area; Walter W. Stake, eastern region; George P. Hough, midwest region; L. M. Keating, southwestern region; Allen O. Dragge, western region.

▸ *INSTITUTE OF HEATING & AIR CONDITIONING INDUSTRIES*—Kenneth N. Robertson, president; William Kell, Don Kissell, Clint Conatser, vice presidents; Ed Myers, Jr., secretary-treasurer. Directors are Russell Crotwell, Craig Stirewalt, Nels Hartleben, Alex Banko, Richard Southworth, Arthur Hess, Dave Mills, Al Schlom, John Johnston, Robert K. Von Der Lohe.

▸ *WATERMAN-WATERBURY CO.*—Ray J. Dervey, president.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—C. M. Sanders, in charge of developing new products and promotion of existing controls; J. F. Cummiskey, director of activities of five market sales managers; V. D. Wissmiller, director of manufacturer sales, responsible for establishment of sales policy, financial planning.

▸ *JOY MFG. CO.*—Raymond Mancha, ventilation vice president for the past 12 years, has retired from active business to provide time for pursuit of personal interests and study. He will work on advanced concepts of mine and industrial ventilation principles.

▸ *O. A. SUTTON CORP., INC.*—Harold F. Hildreth, president and general manager.

WHO'S WHAT

Continued

▸ *AIR MOVING & CONDITIONING ASSOCIATION, INC.*—Albert S. Sheppard, staff engineer. He is concerned chiefly with new program for certifying performance ratings of air moving equipment. Mr. Sheppard formerly was a test and development engineer at Chrysler Corp.

▸ *L. J. WING MFG. CO., DIV. OF AERO SUPPLY MFG. CO., INC.*—Theodore R. Peyrek, vice president for sales.

▸ *E. I. DU PONT DE NEMOURS & CO.*—Dr. Donovan E. Kvalnes, technical manager of "Freon" products division, has assumed additional duties as sales development manager; Dr. Edmond G. Young, manager of development conferences in marketing research division of development department; Dr. Frank W. Blodgett, technical assistant to Dr. Kvalnes.

▸ *COMMONWEALTH EDISON CO.*—Raymond D. Maxson, senior vice president, will serve as senior consulting engineer at the Sargent & Lundy engineering firm April 1. He also will serve the utility as senior consulting engineer. Mr. Maxson will relinquish his present post when the new appointment is effective. In his new position, he will concentrate on the study of atomic power.

▸ *UNITED STATES AIR CONDITIONING CORP.*—Michael H. Pelosi, Jr., manager of engineering and development division; Thomas Tisdel assistant service manager.

▸ *HEAT-X, INC., SUBSIDIARY OF DUNHAM-BUSH, INC.*—Russell E. Comstock, chief engineer; Richard Gardner, application engineer.

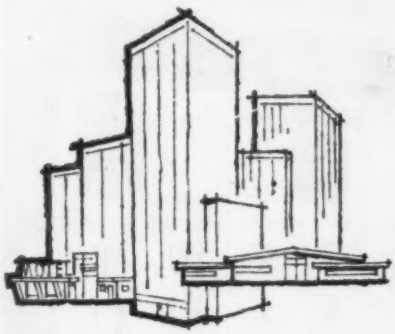
▸ *A. M. BYERS CO.*—A. S. Chalfant, general manager of sales, with sales management staff composed of R. I. Enzian, wrought iron sales; F. E. Farnan, sales promotion; R. J. Bricmont, engineering service.

▸ *HUPP CORP.*—Anthony J. DeFino, vice president; Allan B. MacLaren, director of training and service.

▸ *ALLIS-CHALMERS MFG. CO.*—E. R. Danielson, assistant to W. M. Wallace, vice president and general manager of general products division.

▸ *BATTELLE MEMORIAL INSTITUTE*—Dr. B. D. Thomas, president, to succeed Dr. Clyde Williams who has retired.

▸ *FLICK-REEDY CORP.*—Walter Kudlaty, chief design engineer for "Miller Fluid Power," "Tru-Seal" divisions.



In the new, automatic world you're making...

Your ideas work better when you work with HONEYWELL

More products to give your ideas greater scope. From Honeywell you get a great variety of products both mechanical and electrical. Honeywell is the only company that makes a complete line of pneumatic, electric and electronic controls plus instrumentation for commercial buildings. With Honeywell your choice is wider, your ingenuity less restricted.

More ideas that go with yours. Honeywell has pioneered the concept of central-systems control for commercial buildings, now the accepted trend. This and other Honeywell ideas have increased recognition of the importance of operational equipment, and helped to make your contribution bigger, better and more important.

More support. Honeywell works with you on every job, frees you from annoying details, saves you time, even helps you sell. And the assistance of Honeywell specialists in each of 112 offices throughout the country is as near as your phone.

Look over the Honeywell products and ideas on the following pages. And, remember, each is backed by the kind of support that only Honeywell can offer you.

FOR MORE ... WORK WITH HONEYWELL
TO WORK WITH

WHO'S WHAT

Continued

▸ *INTERNATIONAL NICKEL CO., INC.*—Albert P. Gagnebin and L. E. Grubb, assistant vice presidents.

▸ *CARRIER CORP.*—William H. Macdonald, assistant manager of machinery department; Frank M. Fives, product specialist of industrial air, gas compressors, both in machinery and systems division.

▸ *BITUMINOUS COAL RESEARCH, INC.*—Dr. Harold J. Rose, vice president and consultant; J. R. Garvey, director of research; John W. Igoe, director of administration.

▸ *TUCK-AIRE FURNACE CO.*—Robert C. Boehm, national sales manager.

▸ *JOSEPH T. RYERSON & SON, INC.*—Robert T. Harvey, national product manager.

▸ *ROCKWELL MFG. CO.*—Pat H. Luckett, assistant product manager of gas products for meter and valve division.

▸ *CULLIGAN, INC.*—Dale Bergstedt, manager of sales development.

▸ *ROBINSON CLAY PRODUCT CO.*—A. E. Williams, general sales manager; P. V. Robinson, Jr., sales manager of vitrified division.

▸ *FEDDERS-QUIGAN CORP.*—Joseph Mann, director of forecasts and budgets.

▸ *AMERICAN GAS ASSOCIATION*—Seward Abbott, utilization engineer at Washington, D. C., office.

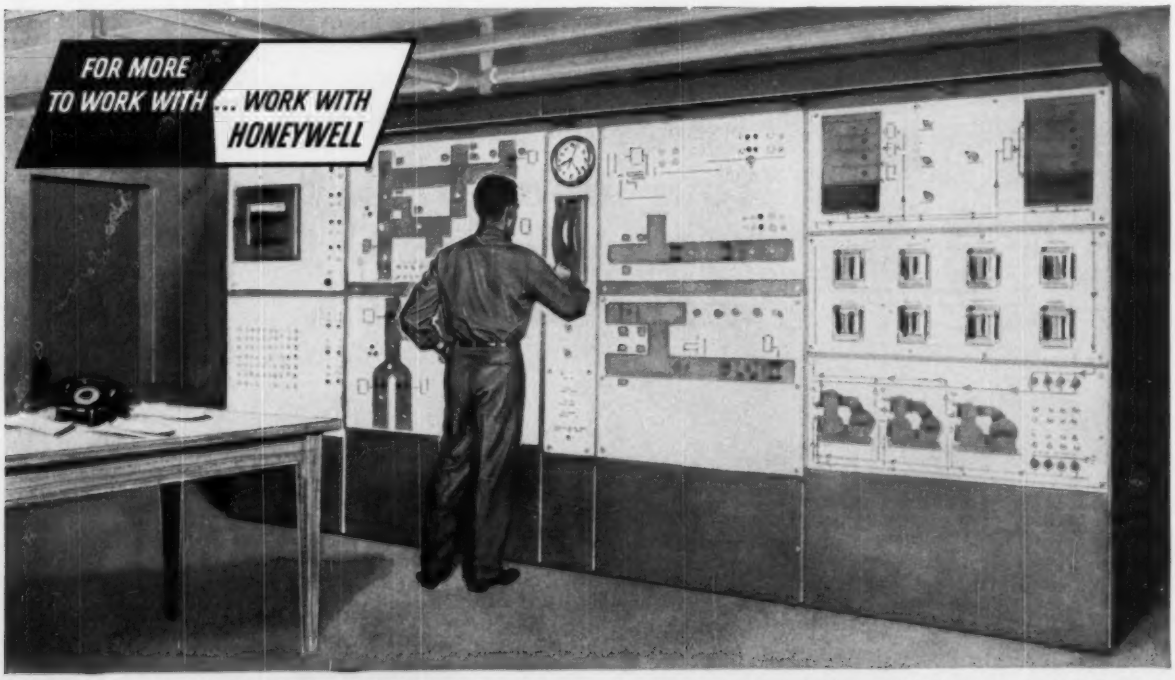
▸ *REMINGTON AIR CONDITIONING DIV., REMINGTON CORP.*—Ray R. Richardson, service manager.

▸ *MUELLER CLIMATROL, DIV. OF WORTHINGTON CORP.*—Walter W. Braatz, supervisor of quality control.

▸ *KEASBEY & MATTISON CO.*—Hugh M. Carleton, process and product investigation supervisor.

▸ *WHITE-RODGERS CO.*—Russell E. Shaffar, director of purchases.

▸ *AMERICAN-STANDARD, PLUMBING AND HEATING DIV.*—C. J. Hurray and L. B. Neb, managers of enamel plants in Louisville and Richmond, Calif., respectively.



Supervisory Data Center for the Philadelphia Transportation Center, a unique 18 story building which includes offices, stores and a bus terminal. It is another in the long list of buildings to use a Honeywell Supervisory DataCenter to centrally control its entire year 'round air conditioning. Owner and Builder: McCloskey & Company; Architect: Vincent G. Kling; Mechanical and Electrical Engineers: Robert J. Sigel, Incorporated; Structural Engineers: McCormick & Taylor Associates.

WHO'S WHAT *Continued*

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *CARRIER CORP.* — Roy H. Smiles, eastern regional manager for unitary equipment division; Thomas S. Campion, manager of San Francisco district office for machinery and systems division.

▸ *MILTON ROY CO.* — Four new engineering representatives are: Brosey and Frew, Inc., for major section of Indiana area; Bernhard Engineering Sales Co., North Texas territory; Tate Engineering, Inc., Virginia territory; Jay Instrument and Specialty Co., central, southern Kentucky area.

▸ *TRANE CO.* — Robert R. Williams, sales engineer in Pensacola, Fla.; Raymond Diehl Co., representative in Tallahassee, Fla., area.

▸ *A. M. BYERS CO.* — Jed J. Merrill, division manager for Philadelphia area.

▸ *WESTINGHOUSE ELECTRIC CORP., AIR CONDITIONING DIV.* — William A. Meister, acting manager of newly opened New York branch.

▸ *BABCOCK & WILCOX CO.* — Robert H. Forsyth, manager of Chicago district sales office of refractories division.

▸ *YOUNG RADIATOR CO.* — Walter W. Yendes, sales representative for northern Indiana, adjoining counties in southwestern Michigan; United Equipment Co., sales representative for Columbus, Ohio, area.

▸ *ALLIS-CHALMERS MFG. CO.* — R. E. Morris, manager of industrial sales for industries group in St. Louis district; W. P. Bell, manager of industries group sales in Washington, D. C.

▸ *AMERICAN AIR FILTER CO., INC.* — Frank K. Platt, central regional manager.

▸ *J. F. PRITCHARD & CO.* — New sales representatives are: William B. Wickersham and Co., for Maine, Massachusetts, New Hampshire, Rhode Island, Vermont territory; H. R. LeMay and Co., Inc., for south Texas, southwest Louisiana territory.

▸ *WEBSTER ENGINEERING CO.* — Thermo Dynamics, Inc., representative in northern Illinois, adjacent counties in Indiana.

▸ *GOLDEN-ANDERSON VALVE SPECIALTY CO.* — Stolley & Orlebeke, representative in Chicago area.

*Honeywell Supervisory DataCenter**

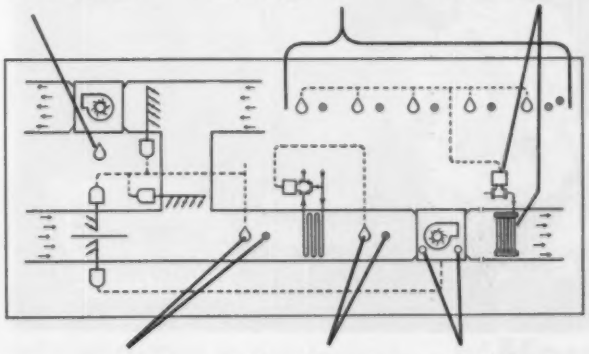
One-man control of a building's entire air conditioning system

Details from just one module of the Supervisory DataCenter in the Philadelphia Transportation Center

A. Exhaust air fan switch. Pilot light indicates operation.

B. Temp. selector knobs and check buttons for each zone.

C. Symbol for steam valve and reheater coil for each zone.



D. Temperature selector knob and check button for the mixed air temperature.

E. Temperature selector knob and check button for air leaving cooling coil.

F. Start-stop buttons for supply air fan. Pilot light in symbol indicates operation.

The DataCenter shown here is an example of the centralization of control for year 'round air conditioning systems. This panel enables one man to check and adjust the temperature at all important points. He simply pushes the check button and reads the temperature on the large indicating dial in the center of the panel. Chilled water, condenser water and cooling tower pumps, compressors, fans and valves can be operated right from the panel. System malfunctions are quickly observed and analyzed right from the panel. Repair crews can be sent to the trouble source.

A systems control center like this can give your clients more efficient operation of their air conditioning system. Honeywell can also include such other functions in your centralized panels as communications, record keeping and alarm and detection systems. A Honeywell specialist will work with you in designing a center to fit your clients' needs. *T. M.

Honeywell ▷

First in Controls

WHO'S WHAT

Continued

▸ *AMERICAN BLOWER, DIV. OF AMERICAN-STANDARD* — New sales engineers are: George T. Sonntag, Salt Lake City; Jeffrey R. Singer, Los Angeles; Roy O. Rose, Tulsa.

▸ *DRAYER-HANSON, DIV. OF NATIONAL-U.S. RADIATOR CORP.* — Sales agents in Florida are: Henry G. Graham, Tampa, central sector; Sanders and Hollander, Miami, southern area; Earl W. Seibert, Ponte Vedra Beach, northern section.

▸ *PHILIP CAREY MFG. CO.* — New sales representatives in insulation sales division are: F. J. Jansen for metropolitan Chicago area; Dale G. Swanson for Minnesota, Wisconsin, sections of Iowa, Illinois; John L. D. Bassett for western Pennsylvania, western New York areas.

▸ *GENERAL ELECTRIC CO., AIR CONDITIONING DIV.* — Star Steel Supply Co., distributor in Michigan territory.

▸ *TRION, INC.* — New representatives are: H. E. Rieckelman Co., Buffalo area; Robert S. Belcher, Tampa territory; Tennity & Co., Los Angeles area.

▸ *O. A. SUTTON CORP.* — Joseph Minarik, branch manager for Vornado Distributing Co., Inc., Baltimore.

▸ *FARR CO.* — Four new representatives are Brownlee-Morrow Co., Alabama territory; Earl W. Seibert, northern Florida, southern Georgia; Robert S. Belcher, central Florida; G. H. Avery Co., Arkansas area.

▸ *McQUAY, INC.* — Case-Orians Co., representative for eastern Michigan territory.

▸ *WALWORTH CO.* — Leo I. S. Conway, assistant manager of New York City metropolitan division.

▸ *WILSON MFG. CO.* — Madden Brass Products Co., national distributor for tube working tools.

▸ *RUUD MFG. CO.* — Fred Peters, sales representative for eastern Michigan.

▸ *HARCRAFT BRASS* — Max Rothenberg Co., Inc., sales representative for metropolitan New York, northern New Jersey territory.

▸ *BRUNER CORP.* — Equipment Sales Co., Inc., district representative for Virginia, North and South Carolina territory.

Electronic Air Cleaner Installation in the Lake Street office of the Northwestern National Bank, Minneapolis, Minn., has in just five months brought a reduction in cleaning, decorating costs, has also reduced maintenance for such delicate working mechanisms as these proof machines.

Bank Mgr.: Leroy H. Berg; Arch. and Eng.: Magney, Tusler & Setter; Gen. Contractor: George W. Madsen Construction Co.; Vent. & Air Conditioning Contractor: O'Brien Sheet Metal Works; Elect. Contractor: Harris Brothers Plumbing Co.; Plumbing & Heating Contractor: J. McClure, Kelley and Co.

WHO'S WHAT — *Continued*

▸ *WESTINGHOUSE ELECTRIC CORP., STURTEVANT DIV.* — Two new sales agents are McNamara Sales Co., for Minnesota, northwest Wisconsin, North and South Dakota territory; A-C Supply Co., for eastern half of Pennsylvania, most of Delaware, New Jersey.

▸ *BALDWIN-HILL CO.* — T. J. Callans and C. R. Reeves, eastern and midwest area managers, respectively, of industrial insulation division.

▸ *PITTSBURGH CORNING CORP.* — James R. Vivian, sales representative at Philadelphia office.

▸ *RITTLING CORP.* — Joseph L. McArdle Co., new England district sales representative with headquarters at new warehouse site, 47 Ellery St., South Boston.

▸ *HAYS MFG. CO.* — Henry E. Miller, Jr., salesman in Missouri, Arkansas, Oklahoma, Kansas territory; Stanley D. LeMaster, Jr., junior salesman in Pittsburgh area.

▸ *E. V. NIELSEN, INC.* — Maurice W. Acre, representative for California, Oregon, Washington, Idaho, Utah, Montana, Wyoming, Colorado, Arizona, Nevada, New Mexico territory.

▸ *KEASBEY & MATTISON CO.* — Charles C. Sprangers, manager of building materials department in Chicago.

▸ *CYCLOTHERM DIV., NATIONAL-U.S. RADIATOR CORP.* — Robert A. D'Elia, manager of Garratt Engineering & Equipment Co., Millbrae, Calif., which serves as sales distributor for the company.

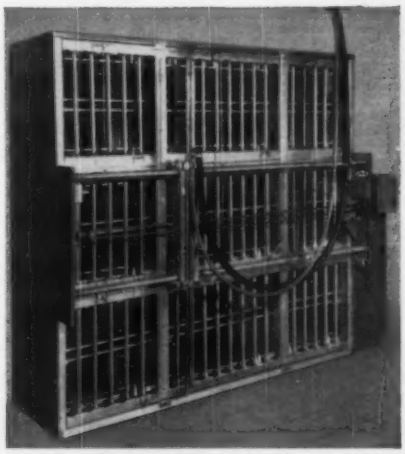
▸ *FLORI PIPE CO. and HOUSTON PIPE STEEL, INC.* — Kenneth E. Martin, head of new western district sales office. He will serve Washington, Oregon, California, Nevada, Utah, Arizona.

▸ *DUNHAM-BUSH, INC.* — New headquarters for New England district sales office is at 171 South St., West Hartford, Conn. Lee Babin serves as manager. Henry A. Boudolf, sales engineer, St. Louis district office.

▸ *AUTOMATIC SWITCH CO.* — Distributors of "Asco" solenoid valves are Sterns Electric Equipment Co., Buffalo; Electric Sales and Engineering Co., Milwaukee; Butler and Land, Dallas and Shreveport; Connecticut Plumbing Supply Co., Stamford; Fischer Industrial Equipment Co., Cincinnati. ⧺

For your mechanical systems... Honeywell's Electronic Air Cleaner

eliminates dirt six times more effectively than ordinary filters.*



EASY INSTALLATION of Field Assembled models is provided by match-marking at factory, regularity of cell building blocks and detailed instructions provided with each model. Modular construction allows fabrication in almost any size.

The Honeywell Electronic Air Cleaner gives your clients reduced cleaning and decorating costs, reduced maintenance for machinery, better health and comfort for personnel. And it very often reduces heating and cooling costs because the amount of outside air taken into the building can usually be decreased.

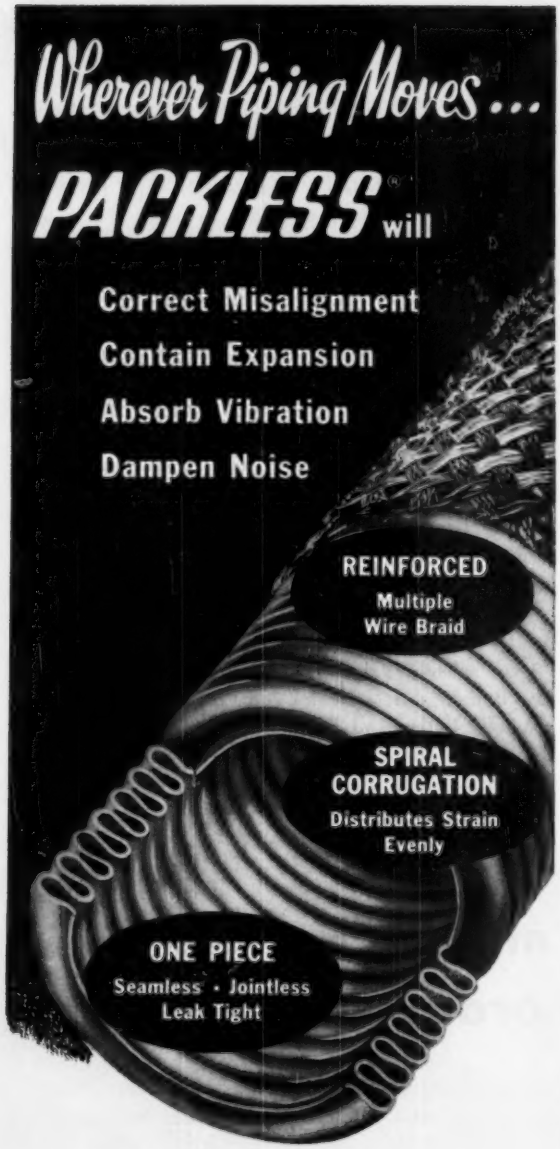
Two types of Honeywell Electronic Air Cleaners are available to fit any air conditioning or ventilating system: Field Assembled models which are built and tested at the factory, disassembled and shipped to job site for erection in the ductwork; and Custom Package models, built with a package-enclosure, tested and shipped completely assembled for installation.

For expert information and assistance in specifying, or installing Honeywell Electronic Air Cleaners, call the Honeywell office nearest you. Or write Honeywell, Dept. AC-2-32, Minneapolis 8, Minn.

**According to tests developed at the National Bureau of Standards.*

Honeywell

First in Controls



PACKLESS®

Flexible Metal Hose & Fittings

MATERIALS—BRONZE, STAINLESS AND CARBON STEEL
SIZES —1/4" THRU 6" I.D.
FITTINGS —BRAZED, MECHANICAL, SOLDERED.

Most types for various applications are stocked for immediate shipment.
Send for Bulletin IND-4

PACKLESS METAL HOSE INC.

730-12 South Columbus Ave., Mt. Vernon, N. Y.

WE HEAR THAT...

▸ *PITTSBURGH PLATE GLASS CO.* plans to build a large continuous glass fiber yarn plant at Shelby, N. C. The new structure is scheduled for completion within 12 months after construction gets underway shortly. Partial production is expected to begin as soon as the building is completed. The multi-million dollar plant will contain more than 350,000 sq ft of floor space and will be air conditioned. It will have 16 glass furnaces capable of producing 25,000,000 lb of yarn a year.

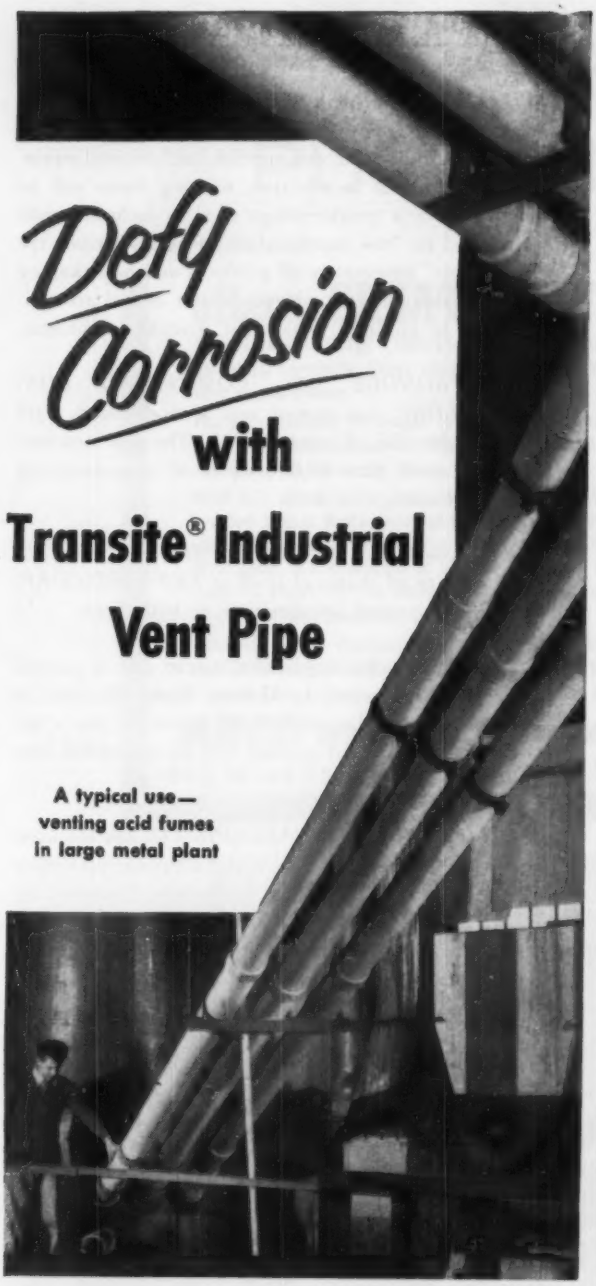
▸ Proposed standards for thermal design of high temperature hot water heat exchangers were finalized and referred to a subcommittee at the fall meeting of the *FUEL OIL AND WATER HEATER MANUFACTURERS' ASSOCIATION*. These standards are slated to be approved and adopted at the next meeting. The association is devoted to the improvement, increased performance, and the standardization of shell and tube heat transfer equipment.

▸ *COND-AIR DIV., ELLIOTT ENGINEERING CO.* has moved into its recently completed plant in Lynwood, Calif. The new plant covers 25,000 sq ft, and production facilities include a complete group of metal working machinery, a large paint room, a testing room, storage space, an engineering department, and offices.

▸ Total plant area of *CHESTER CABLE CORP.* is now 200,000 sq ft of floor space — an increase of 75,000 sq ft. Three phases in the company's expansion program completed include additional storage area, new production machinery and processes, equipment for research, and larger experimental sections for testing materials and finished products.

▸ The bituminous coal industry, major coal users, and companies that supply materials and equipment to the coal industry have joined in an effort to establish a major coal research center in Pittsburgh. Completion date on the project is slated for 1959. *BITUMINOUS COAL RESEARCH, INC.* will have the responsibility for operating the new facility. A decision was reached by the organization's board of directors to consolidate the industry's research facilities in the "Steel City." The consolidation will combine the present laboratory operated by the coal industry in Columbus, Ohio, the laboratory and administrative headquarters in Pittsburgh, and the organization's fiscal offices located in Washington, D. C.

The program at the new center will include basic research to fill in gaps in the knowledge of the origin, physical structure, properties, and chemical behavior of coal. Activities will emphasize the development of improved coal utilization methods and equipment.



Defy Corrosion with Transite® Industrial Vent Pipe

A typical use—venting acid fumes in large metal plant

In severe venting services, Transite's outstanding performance is a matter of record. Made of asbestos and cement, two of nature's most indestructible materials, it resists the attack of most fumes, vapors, and dusts.

Installed indoors or out, Transite Industrial Vent Pipe can't rust or rot, never needs paint, nor other protective coating. Wide variety of fittings makes it adaptable to any layout. For more information, write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

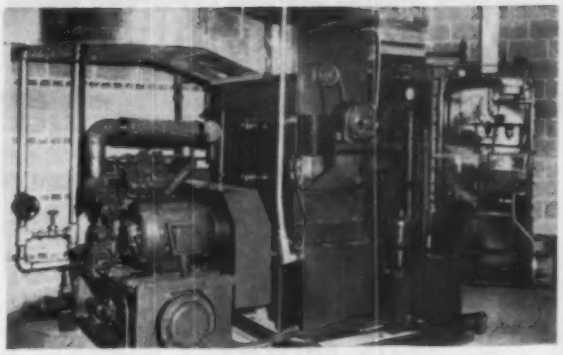
Johns-Manville

TRANSITE INDUSTRIAL VENT PIPE

An Asbestos-Cement Product

DRY AIR...

PRECISELY as you want it



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Write for full information; ask for Bulletins 112 and 121. Address Dept. HP-2

NIAGARA BLOWER COMPANY

405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities of U.S. and Canada

How to simplify
air conditioning system
water treatment

Here's servicing of air conditioner water in the easiest possible way. A routine 10 minute daily check by one man, and Oakite Airefiner No. 52 ... that's all it takes. You end scale, slime, algae and corrosion troubles. You avoid out-of-service time, and maintain cooling efficiency.

The entire operation is simplicity itself. (1) Charge water initially with economical Oakite Airefiner No. 52. (2) A simple once-a-day check of water tells whether any adjustment is needed. (3) Add upkeep, if necessary. (4) Periodically, drain system and replenish with fresh, charged water.

Oakite Airefiner No. 52 leaves no deposit on tubes, is safe, and costs little for initial charge as well as upkeep.

Call in the local Oakite Technical Service Representative to get details and drawings on this money- and trouble-saving procedure. Or write Oakite Products, Inc., 32D Rector Street, New York 6, N. Y.

OAKITE

Export Division
Cable Address: Oakite

specialized
WATER TREATING
materials

Technical Service Representatives in Principal Cities of U. S. and Canada

WE HEAR THAT

Continued

▸ *HAMMOND BRASS WORKS* has announced expansion of its line to include high pressure valves for heavy duty industrial, commercial, and original equipment application. In addition, existing items will be introduced in a greater range of sizes including gate valves to 3 in. New merchandising features include the "Brite-Kote" process on all products and a packaging program designed to achieve greater brand recognition and to minimize wholesaler inventory problems.

▸ *ELECTROMODE DIV., COMMERCIAL CONTROLS CORP.* has moved into a modernized plant at 570 Culver Rd., Rochester, N. Y. The new structure provides more than 80,000 sq ft of manufacturing space and storage facilities.

▸ A proposal that *AMERICAN AIR FILTER CO., INC.* acquire all shares of stock of *KENNARD CORP.* has been approved by directors of both firms.

▸ *TRION, INC.* has acquired a 2 acre plot of ground adjacent to its factory in McKees Rocks, Pa. One of two buildings at the site will be converted into a research laboratory and another will be remodeled into a warehouse.

▸ *ECLIPSE FUEL ENGINEERING CO.* has acquired exclusive rights to patents, manufacturing, and sales of the vane type indicating flowmeters developed by *R. A. EKSTROM & CO.* The product line of flowmeters includes five basic styles for gases and liquids available to handle a variety of ranges and pressures to 2000 psi.

▸ A new Cleveland warehouse has been constructed by *MAUREY MFG. CORP.* at 3200 Lakeside Ave.

▸ *RUBATEX DIV. OF GREAT AMERICAN INDUSTRIES, INC.* has embarked upon a $1 million expansion program designed to boost capacity almost 50 percent. A second plant has been purchased in Bedford, Va., which will be used for secondary manufacturing operations.

▸ The industrial insulations division of *JOHNS-MANVILLE* has named *SCHRIBER SHEET METAL & ROOFERS, INC.* as its insulation contract unit for the Dayton, Ohio, area.

▸ *ALUMINUM TUBING CO.* has been renamed *ROLL-WELD PIPE AND TUBE, INC.* The company recently expanded its operations with the addition of two new pipe mills. Steel and stainless steel as well as aluminum pipe and tubing will be produced in outside diameters ranging ½ through 14 in. in wall thicknesses 0.028 through 0.250 in. ⫩

A new concept in air filters

PURE-AIR FILTER

offers GREATER EFFICIENCY-LOWER COSTS

The PURE-AIR FILTER CONSISTS of a highly efficient filter pad of UN-OILED synthetic fibers supported by a cadmium plated permanent metal frame.

There is nothing to wash, dry or re-oil, simply dispose of filter pads when dirty. Cost of replacement pads is far less than conventional throw-away filters.

PURE-AIR filter pads are made of non-woven synthetic fibers bonded into a fluffy blanket-like pad with millions of microscopic air passages — that's why they stop DIRT not AIR. PURE-AIR filter pads are available in a wide range of efficiencies and densities to meet all requirements. For special application, write for additional information.

PURE-AIR filter replacement pads weigh about one (1) ounce each, reducing labor costs and storaging facilities.

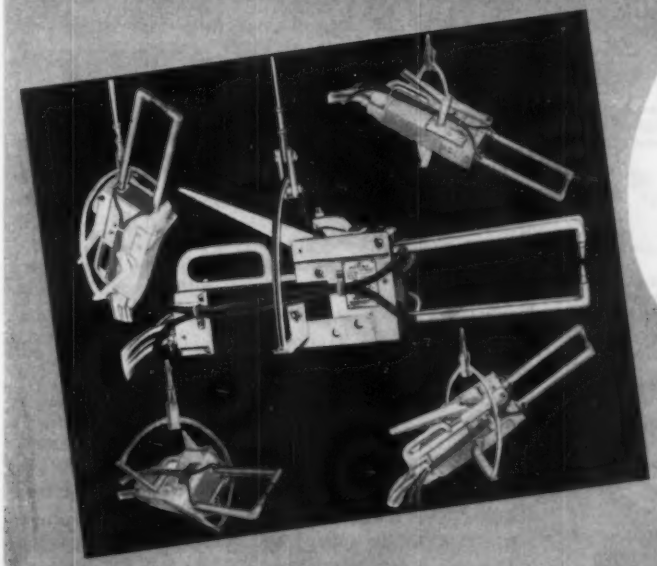
Write for bulletin. Representative wanted in principal cities.

Removal of pad is simple . . . the retainer ring is pulled out, snapped back when the new PURE-AIR pad is in place.

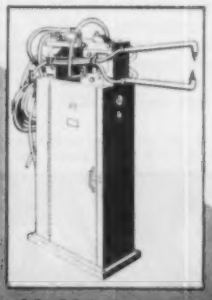
ARCO manufacturing corp.

542 West 55th St. New York 19, N.Y.

HANDY... any way you look at it



Ball bearing suspension ring takes all the weight and much of the work out of welding with a Miller MPS water-cooled portable spot welder. Choice of manual or air operated models, all with timers. 6" tongs secure work with pressure to 600 pounds. Model MPS-10-KVA weighs 79 lbs., welds up to 3/16" thickness; model MPS-20-KVA, 91 lbs., handles material to 1/4"; air operated models average 53 lbs. more. Wide choice of tongs.



Steel pedestals are available for both models.

miller ELECTRIC MANUFACTURING COMPANY, INC.

APPLETON, WISCONSIN

distributed in Canada by CANADIAN LIQUID AIR CO., LTD., Montreal

"WINTERIZE"

to
eliminate drafts
reduce heat losses
improve fan efficiency
with new

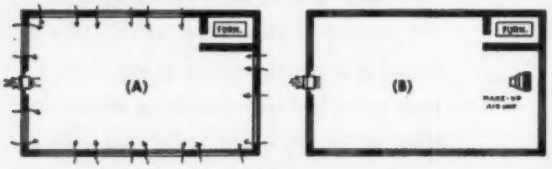
MODEL 48MU210
48" 4-blade unit
equipped with elbow

Aerovent INDUSTRIAL

AIR MAKE-UP UNITS

Performance of fans and ventilating equipment installed to exhaust from production and processing areas depends *entirely* upon the availability of ENOUGH AIR! Without sufficient quantities to replace air exhausted, the air-handling system is soon "starved," creating a negative pressure or "vacuum" condition which is responsible for infiltration of outside air around doors and windows. The effect of the resulting draft places an additional work load on the plant heating system, with an ultimate decline in temperatures throughout the working area.

here's a typical "MU" installation



Warm air, exhausted from a machine shop area, replaced by cold air pulled through cracks and door openings (A). Filtered and tempered air, supplied by Air Make-Up Unit installed in same area (B) helps to maintain constant temperatures; levels-off "peaks" and "valleys" in boiler or furnace loading.

New Aerovent Industrial Air "Make-Up" Units, designed to supply ample quantities of clean, pre-heated air, aid in maintaining peak fan performance, reducing drafts and in stabilizing uniform heating loads. Available in seven unit arrangements in sizes 24" to 54" for capacities to 33,000 CFM. Write for free Bulletin 850.

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MEETINGS & CONVENTIONS

1958

FEB. 17-20—*Seventh Annual Industrial Ventilation Conference.* Kellogg Center, Michigan State University, East Lansing, Mich. Information: Industrial Ventilation Conference, Continuing Education Service, Michigan State University, East Lansing, Mich.

MARCH 1—*Association for Applied Solar Energy,* first junior solar symposium. Arizona State College, Tempe, Ariz. AASE headquarters: Suite 202, Central Plaza Bldg., Phoenix, Ariz.

MARCH 17-21—*National Association of Corrosion Engineers,* 14th annual conference and exposition. Civic Auditorium, San Francisco. NACE headquarters: 1061 M & M Bldg., Houston 2.

MARCH 17-21—1958 *Nuclear Congress.* International Amphitheater, Chicago. Information: Engineers Joint Council, 29 W. 39th St., New York 18.

MARCH 26-28—*American Power Conference,* 20th anniversary meeting. Hotel Sherman, Chicago. Sponsored by Illinois Institute of Technology. Information: R. A. Budenholzer, conference director, Mechanical Engineering Dept., Illinois Institute of Technology, 3300 Federal St., Chicago 16.

MARCH 31-*APRIL* 2—*Gas Appliance Manufacturer's Association,* annual meeting. The Greenbrier, White Sulphur Springs, W. Va. GAMA headquarters: 60 E. 42nd St., New York 17.

MAY 4-7—*Air-Conditioning and Refrigeration Institute,* annual meeting. The Homestead, Hot Springs, Va. ARI headquarters: 1346 Connecticut Ave., N. W., Washington 6, D. C.

MAY 7-11—*Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference.* Shrine Exposition Hall, Los Angeles. Sponsored by Western Air Conditioning Industries Association. Information: Fred J. Tabery, exhibit manager, 3443 S. Hill St., Los Angeles 7.

MAY 8-10—*Sheet Metal and Air Conditioning Contractors' National Association, Inc.,* annual convention. Eden Roc Hotel, Miami Beach. Information: Joseph D. Wilder, executive secretary, 170 Division St., Elgin, Ill.

MAY 11-14—*Fluid Controls Institute, Inc.* Lake Placid Club, Lake Placid, N. Y. Information: Fluid Controls Institute, Inc., P. O. Box 191, Decatur, Ill.

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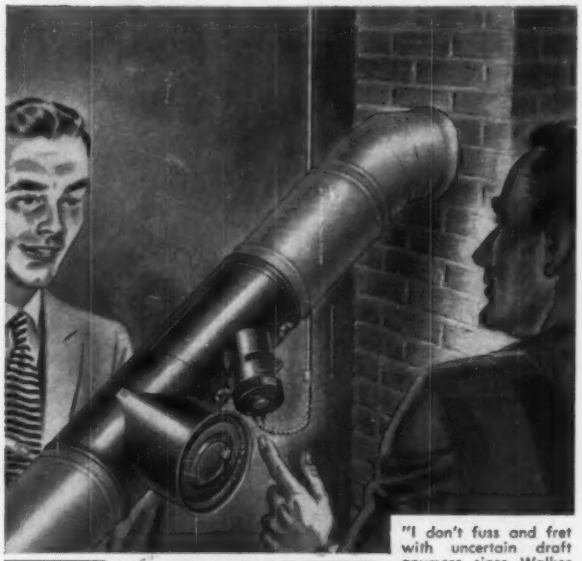

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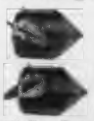
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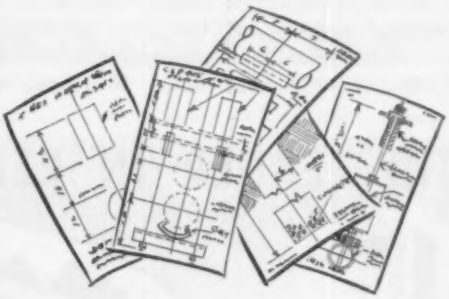

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MEETINGS & CONVENTIONS *Continued*

1958

MAY 19-23—*National Fire Protection Association,* annual meeting. Palmer House, Chicago. The association is at 60 Batterymarch St., Boston.

MAY 20-23—*Mechanical Contractors Association of America, Inc.,* 69th annual convention. Ambassador Hotel, Los Angeles. Information: MCAA haedquarters, 45 Rockefeller Plaza, New York 20.

JUNE 2-5—*National District Heating Association,* 49th annual meeting. French Lick-Sheraton Hotel, French Lick, Ind. Information: John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh 6.

JUNE 9-13—*Fourth International Automation Exposition and International Automation Congress.* Coliseum, New York. Information: Richard Rimbach Assoc., 845 Ridge Ave., Pittsburgh 12.

JUNE 9-13—*Seminar on Electrical Precipitation Equipment.* Pennsylvania State University. Information: Extension Conference Center, Pennsylvania State University, University Park, Pa.

JUNE 22-27—*American Society for Testing Materials,* annual meeting. Hotel Statler, Boston. Information: 1916 Race St., Philadelphia 3.

JUNE 23-25—*American Society of Heating and Air-Conditioning Engineers, Inc.* and *American Society of Refrigerating Engineers,* joint meeting. Hotel Leamington, Minneapolis. ASHAE headquarters: 62 Worth St., New York 13. ASRE headquarters: 234 Fifth Ave., New York 1.

AUG. 7-9—*North Carolina Hospital Engineers Association, Inc.,* 1958 convention. Sir Walter Hotel, Raleigh, N.C. Headquarters: Oteen, N. C.

DEC. 1-3—*American Society of Refrigerating Engineers,* semi-annual meeting. Hotel Roosevelt, New Orleans. Information: 234 Fifth Ave., New York 1.

1959

JAN. 26-30—*14th International Heating and Air-Conditioning Exposition.* Philadelphia. Under auspices of the American Society of Heating and Air-Conditioning Engineers, in conjunction with its 65th annual meeting, also in Philadelphia. Exposition management: International Heating and Air-Conditioning Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13. ∓

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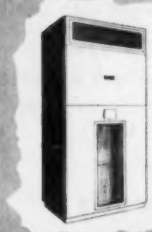

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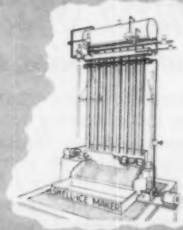

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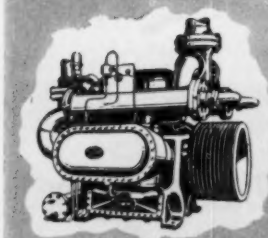

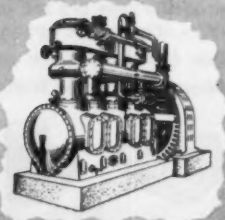

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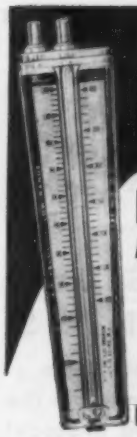

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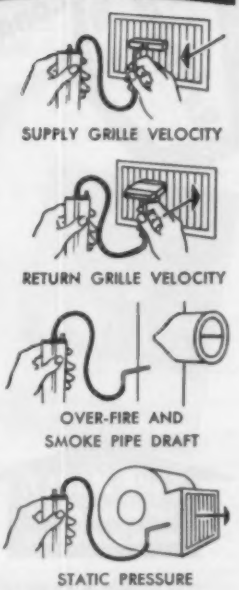

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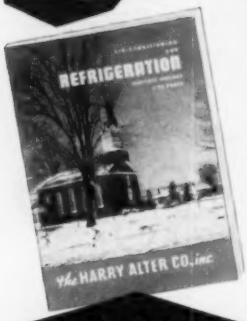

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PROCEEDINGS OF THE SIXTH ANNUAL WATER SYMPOSIUM — Bulletin No. 59. Engineering Experiment Station, Louisiana State University, Baton Rouge 3, La. $1.75.

ENGINEERING AND TECHNICAL CONVENTIONS — Sixth Ed. Compiled by Deutsch & Shea, Inc. Industrial Relations News, Inc., 230 W. 41st St., New York 36. $3.00.

SUPPLY AND DEMAND OF ENGINEERS—1950-1960 — IRN publication. Industrial Relations News, 230 W. 41st St., New York 36. $3.00.

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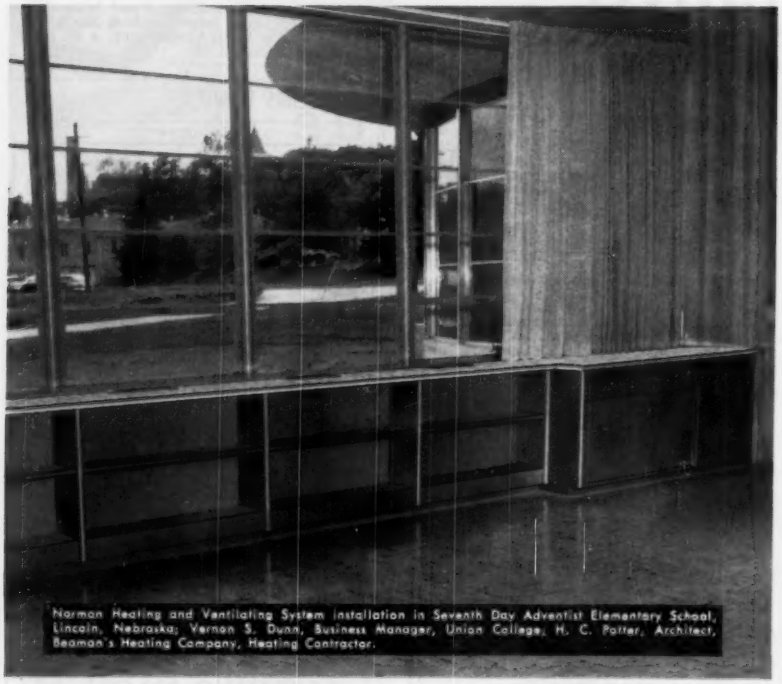

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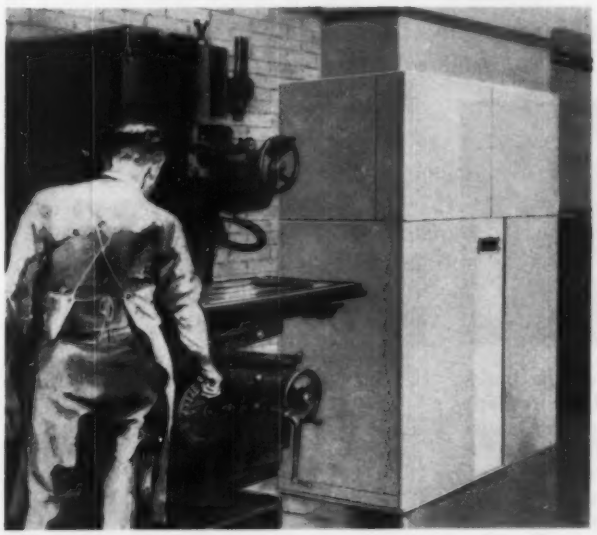
GENERAL ELECTRIC TAKES A GIANT STEP

Simplifies Air Conditioning for Big Projects . . . with New G-E Factory-Assembled Central Station Units . . . Water-Cooled and Air-Cooled



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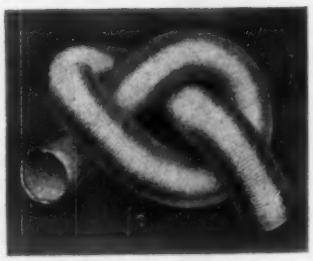

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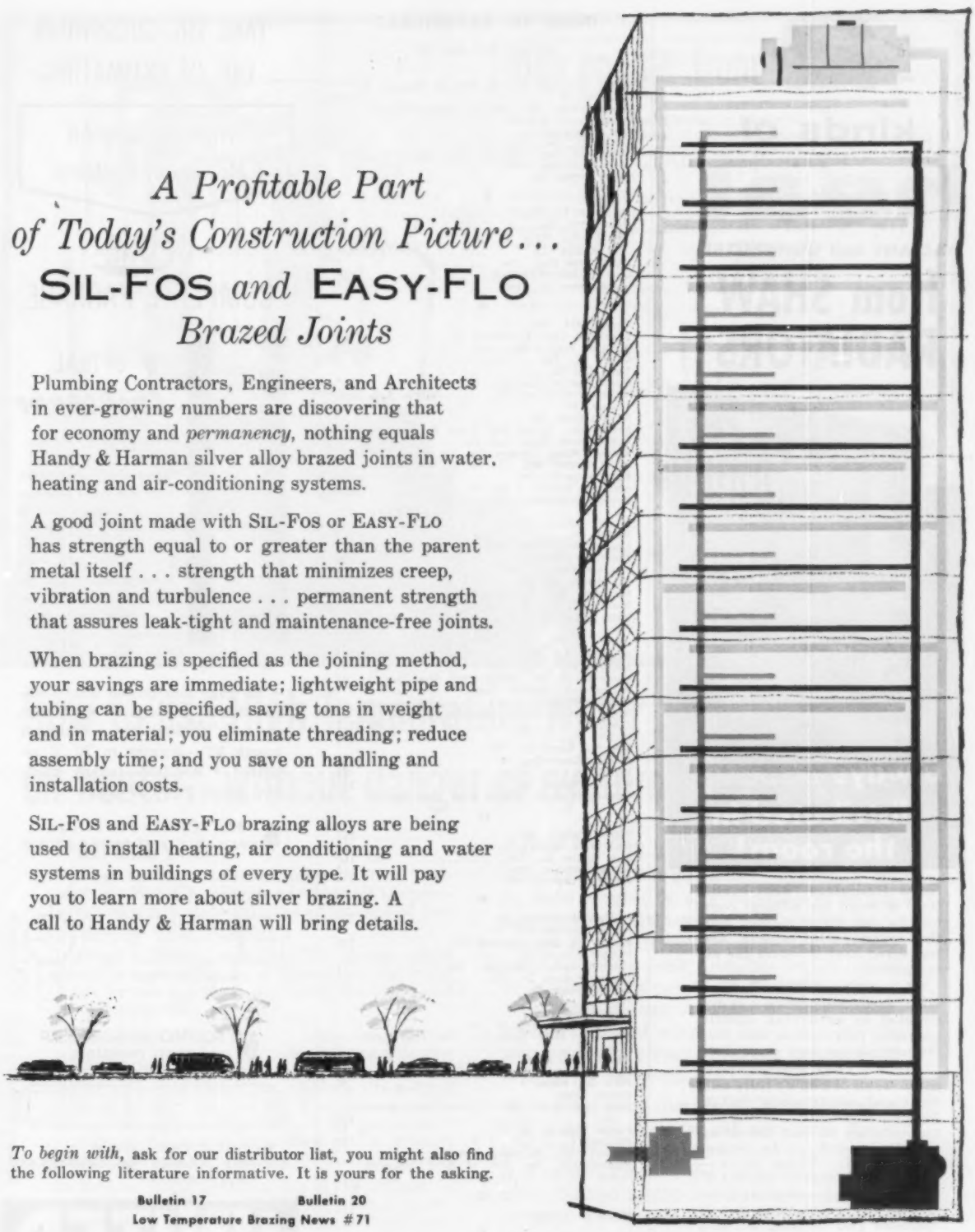

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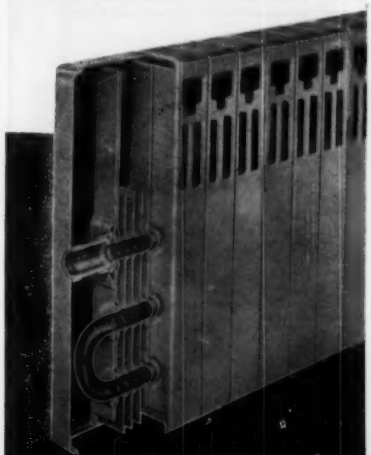
from SHAW RADIATORS



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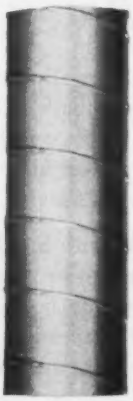

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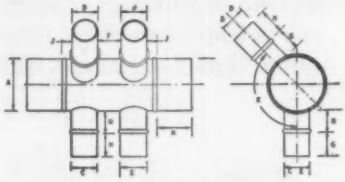

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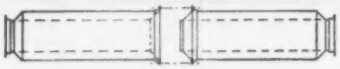

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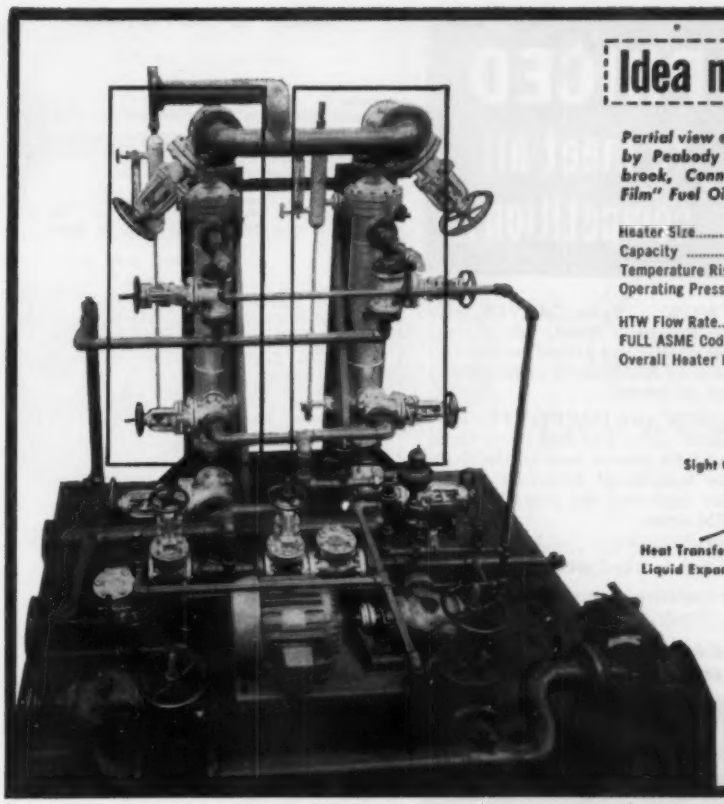
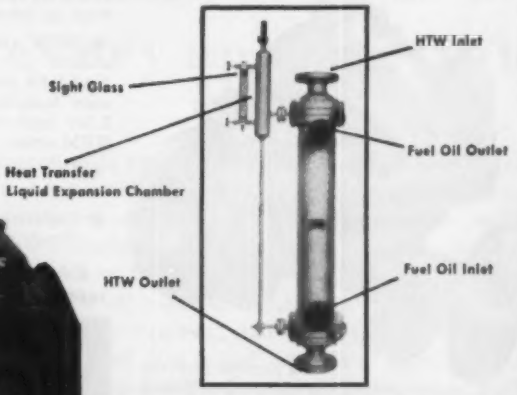


Idea no. 2 from Paracoil

Partial view of pump and heater set fabricated by Peabody Engineering Corporation, Glenbrook, Connecticut, utilizing two "Thermo-Film" Fuel Oil Heaters of these specifications:

Heater Size	FF-48 HTW "Thermo-Film"
Capacity	7500 lbs. No. 6 oil per hour
Temperature Rise	80°F to 210°F
Operating Pressures	300 psi, water side 315 psi, oil side
HTW Flow Rate	100 GPM at 370°F
FULL ASME Code Construction	
Overall Heater Dimensions	15" x 6'-6"



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The pre-heating of #6 fuel oil with High Temperature Water to provide adequate oil temperature and eliminate possibility of leakage of fuel oil into the HTW stream.

Leakage of fuel oil into the HTW stream would result in contamination of the system and could cause serious and costly damage to the boiler and the entire system.

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In both of these systems, the HTW stream is safely isolated from the fuel oil heater by an intermediate secondary circuit. But effective as these methods are, they both require a minimum of two heat exchangers, additional space and additional connecting piping, regulators, level controls, etc.

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Now for the first time the Paracoil "Thermo-Film" Fuel Oil Heater furnishes the optimum solution to the problem. **In a single exchanger** the "Thermo-Film" Heater provides adequate oil temperature, isolation of the HTW circuit from the oil circuit, a reduction in space requirements, simplicity of operation and substantially lower initial installation cost. A number of double tube elements are enclosed within the heater shell providing three circuits: the primary HTW circuit, an intermediate heat transfer fluid circuit, and the oil circuit.

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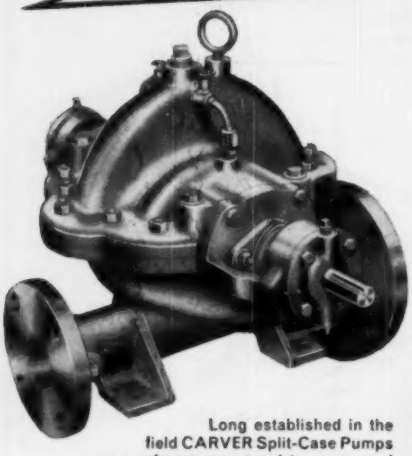

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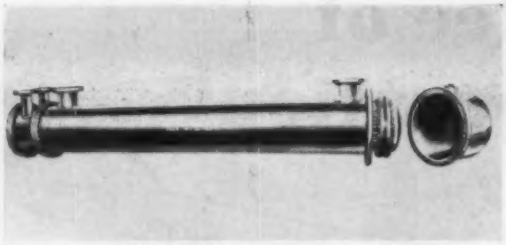
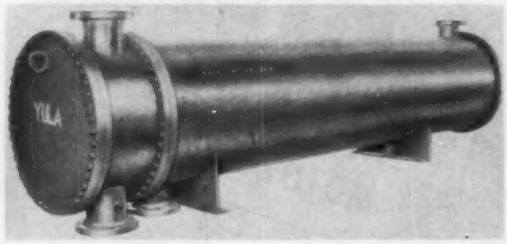
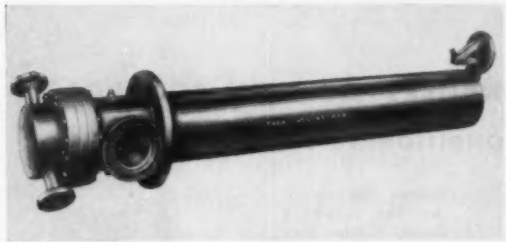


Full Floating Head Exchanger.

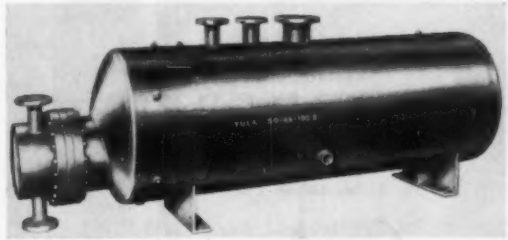


Channel Type Interchanger — for water-to-water application in Air Conditioning.

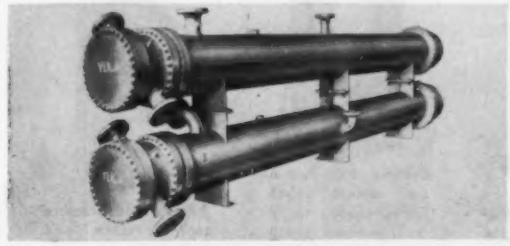
Straight Tube Channel Type Convertor — for Heating, Zone Systems, Snow Melting where either steam or water is the heating medium.



Oil Tank Suction Heater with Check Valve.



Unfired High Temperature Hot Water Steam Generator.



High Pressure Floating Head Oil Heaters — for Power Plant Application.

Yula

a complete line of heat transfer equipment for every application

Our organization is experienced in the design and fabrication of heat exchangers for commercial, process, chemical, refinery and marine requirements. In addition, we have made a specialty of the application of High Temperature Hot Water as a heating medium through the use of transfer equipment. We are still old fashioned in one respect; that a satisfied customer is valuable. Because of this belief, we offer; quality, fine workmanship, excellent service, free engineering consultation and fair prices. Our shop is A.S.M.E. certified for materials commonly used in fabrication.

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Heat-X, 50-ton packaged water chiller uses Allen-Bradley Bulletin 736, two-step, part-winding starter, rated 60 hp, 220 v. Bulletin 736 starters are made in ratings to 600 hp, 220 v; 1200 hp, 440-550 v.

Air-conditioning and refrigeration units equipped with Allen-Bradley *quality* motor control are a reliable assurance of years and years of trouble free performance.

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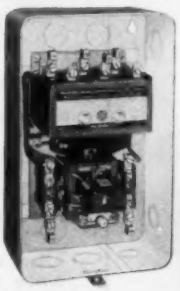
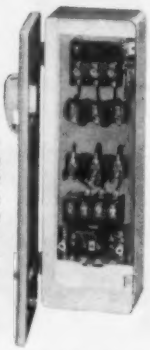
ALLEN-BRADLEY QUALITY CONTROLS

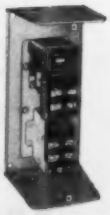
FOR AIR CONDITIONING AND REFRIGERATION



Bulletin 709 across-the-line solenoid starter. 8 Sizes. Max ratings: 300 hp, 220 v; 600 hp, 440-550 v.

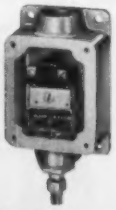


Bulletin 712 combination starter. Visible contact disconnect switch. Max ratings: 100 hp, 220 v; 200 hp, 550 v. Also available with ITE breakers for disconnect. See Bulletin 713.



Bulletin 849 pneumatic timer. Time is adjustable from 1/6 to 180 sec. Many styles.

Bulletin 800, two-in-one, selector switch. Quick change for 2- or 3-position operation. Also available with pilot light.



Bulletin 836 pressure control in NEMA Type 4 watertight and weatherproof enclosure.

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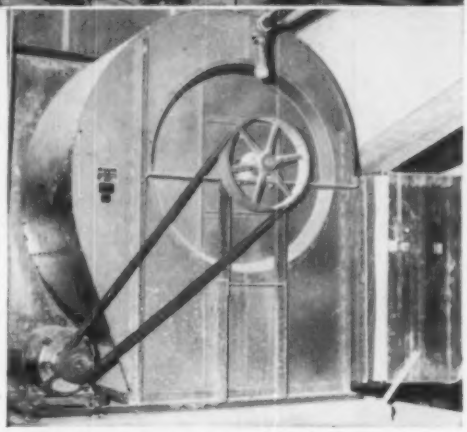
C. Wallace Plumbing Co., Inc.
Dallas, Texas

Another Coliseum Chooses Clarage Air Handling and Conditioning Equipment

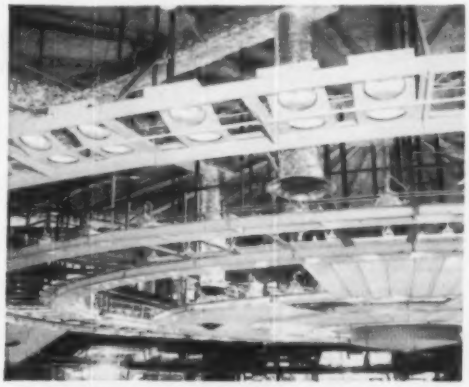
IMPRESSIVE in the Texas tradition is the new Dallas Memorial Auditorium. Its circular arena building, reportedly the largest cement domed structure in the nation, connects with a convention building and lyceum, shown on the right above.

Air handling throughout this vastness was assigned to Clarage equipment — Multitherm conditioning units, Unicoil sprayed coil units, giant system fans, ventilating sets.

Here again, as in New York's new Coliseum and other prominent buildings of all types, Clarage equipment was chosen for its recognized ability to perform quietly, economically, and dependably. CLARAGE FAN COMPANY, Kalamazoo, Mich.



One of several Clarage Type NH fans located in the outer ring which encircles the Coliseum's dome.



Arrangement of air conditioning ductwork, viewed before completion of the ceiling.

CLARAGE ... *dependable equipment for making air your servant*

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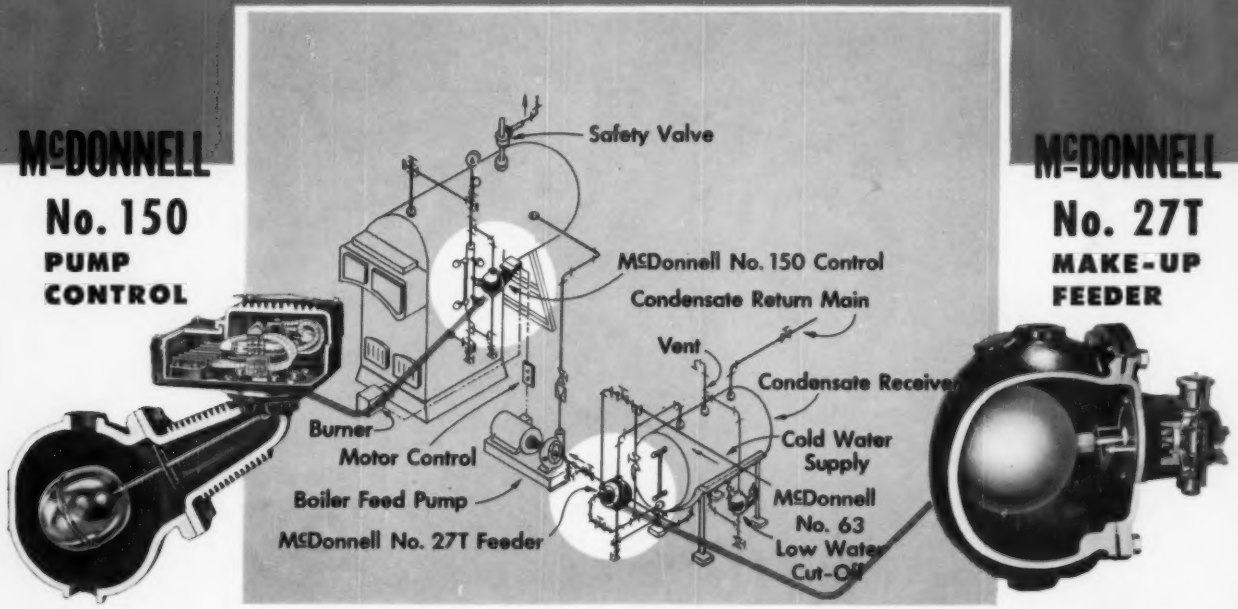
Here's the GREAT COMBINATION for those Medium Pressure Boilers

McDONNELL No. 150 PUMP CONTROL



McDONNELL No. 27T MAKE-UP FEEDER

Pump Control, Low-Water Fuel Cut-off and Low Water Alarm

The No. 150 has two mercury switches. One provides a circuit for starting and stopping feed pump; the other has circuits for low-water cut-off of the burner and for low-water alarm bell if desired. Underwriters' listed.

It is built throughout to stand up under pressure and temperature encountered in boilers of any type or size; maximum steam pressure, 150 lbs. It has no stuffing boxes to cause trouble. Packless construction is provided by extra-heavy monel sylphon bellows. Switch leads have heat-impervious, porcelain-bead insulation. Mechanism is sealed to guard against tampering. Thousands of installations attest the dependability of this control.

How to use them . . .

This is the team of thoroughbreds that takes all the worries and troubles out of water level and feed pump control for medium pressure boilers—boilers with steam pressures up to 150 psi.

The drawing above shows the simple hook-up. The No. 150 controls the boiler feed pump directly from the boiler water level. This holds the boiler water level within close limits that assures maximum steaming efficiency and fuel economy. Any deficiency in the returns is at once replaced by the No. 27T Make-up Water Feeder on the receiver.

An extra switch on the No. 150 provides circuits for cutting off burner and sounding low water alarm in the event of some emergency such as current interruption in the pump circuit or failure of make-up water supply.

Yes, this set-up gives you close control of the water level and maximum protection from low water. Ask for simple installation and wiring diagrams.

Float-operated make-up water feeder for receiving tanks

The No. 27T is particularly suited for the task of maintaining the minimum water level required in condensate receiving tanks.

With a large water feeding capacity, it is capable of meeting any sudden demands of make-up water required by the boiler and the process system. The ample capacity further allows the No. 27T to be mounted at a relatively low point on the receiving tank. This provides adequate space for the return condensate, and prevents wasteful overflow. Its sturdy design and rugged construction enables it to withstand the unusually turbulent conditions often prevalent in the receiving tank. For tank pressures to 35 lbs., water supply pressures to 100 lbs. Other McDonnell Make-up Feeders, including flange-mounted types, available for almost all needs.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

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McDONNELL *Boiler Water Level Controls*